Engineering News-Record

A Consolidation of Engineering News and Engineering Record
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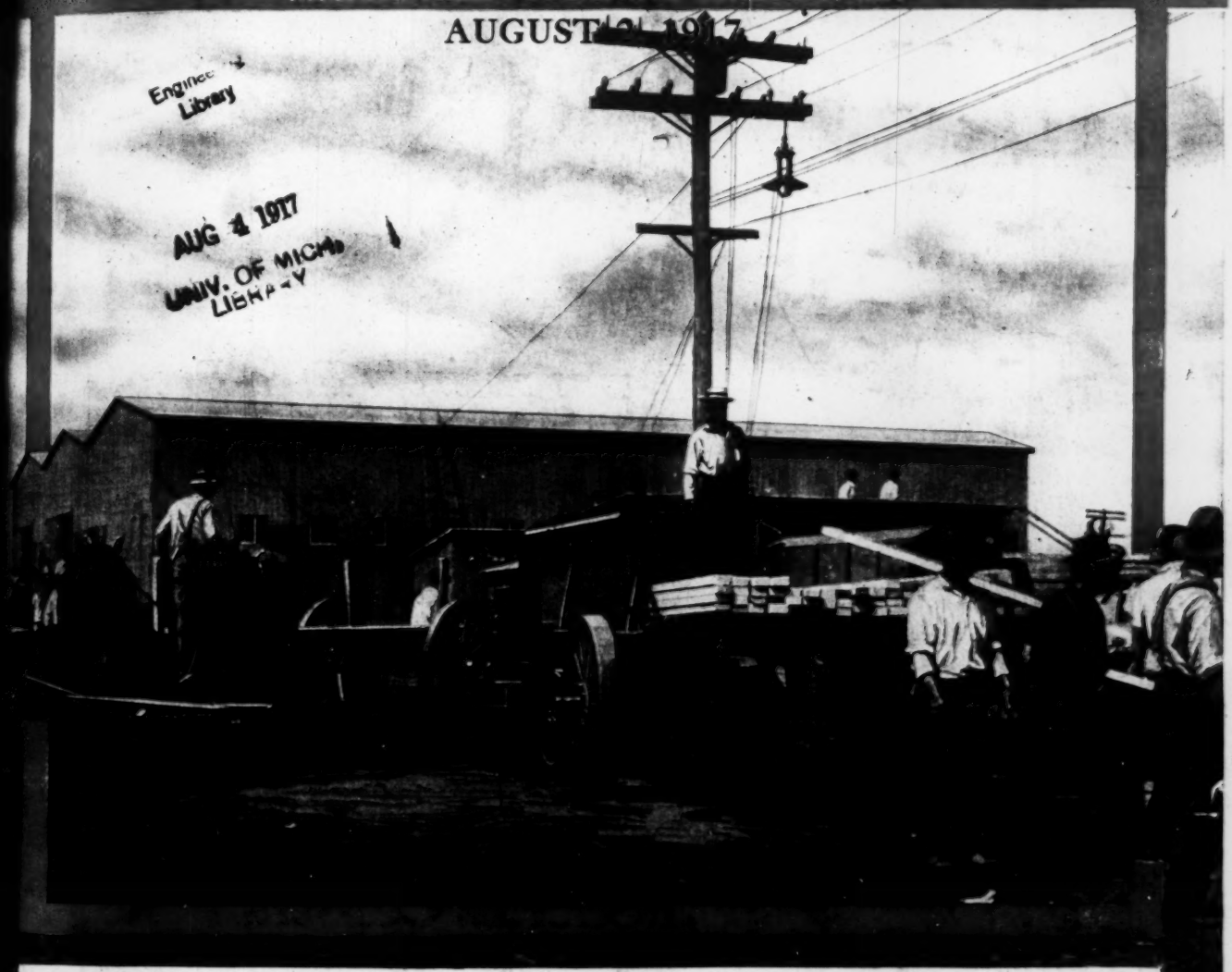

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"It was entirely Fire-Proof—excepting the Roof"

On the night of November 23, 1916, this Ohio *manufacturer of fireproof* sash and doors watched his large, modern, concrete and steel factory building burn to the ground.

Orders booked far in advance—plant working at greatest capacity, loaded cars waiting for shipment, all of the visible efforts of his business life, obliterated—in a single night.

Remember, he, himself, was a specialist in fireproof construction, and he *thought* he had a fireproof plant. In his own words—*"This comparatively small amount of wood (in the roof)—an apparently negligible percentage—generated sufficient heat to crack and crumble the solid concrete walls and twist rolled steel girders into knots. Here, at the first test, our wood roof destroyed us."*

Don't let rush construction blind your eyes to the necessity for a fireproof roof, not a roof that you **think** will be fireproof, but one made of materials that you **know** are fireproof.

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Federal Cement Tile

and you will get a roof of concrete—you know that's fireproof. Federal Roofs require no painting, repairs or other maintenance, and will last as long as the building. They are economical from every point of view. Federal Cement Tile is the logical roof for industrial plants.

Federal Tile are made in various styles for every type of roof, both flat and pitched, including Federal Glass Tile, for the famous daylight roof. Send for a copy of "The Indestructible Roof"—it tells the story.

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Federal Cement Tile Company

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

Volume 79 NEW YORK, THURSDAY, AUGUST 2, 1917 Number 5

Continued Contact with Americans Abroad

THE publishers are pleased to announce that *Engineering News-Record* will be forwarded at the regular domestic rate of subscription to every subscriber called outside the United States on military duty. What these engineers are doing abroad will be of the greatest interest to engineers who must remain at home, and the editors hope to be able to report their activities in so far as the censor permits. At the same time they should strive so far as possible to keep in touch with engineering conditions and performances here, so that they will not be too detached from things when they return. Subscribers on foreign service, or those having such service in prospect, should forward to this office their address in official form, so that delays in transmission may be reduced to a minimum.

Army Now Has Enough Engineer Officers

FROM a number of letters which have reached this office it would seem that some readers have interpreted the article "Does the Army Need Engineers as Officers?" in *Engineering News-Record* of July 12, as meaning that there was a shortage of engineer officers in the army. Such was not the intent of the article. It was designed to show that the army needs real engineers; not, as a correspondent had implied, labor foremen. To remove any misunderstanding, however, it should be stated that, thanks to the wonderful response of the American engineers to the call from Washington, there is at present either in training or on the reserve list a full quota of engineer officers to meet immediate needs for general service. In some special assignments there are still openings. The department would, for instance, like to commission about 100 men with first-class railway operating experience and 50 mechanical engineers with good shop experience. The future needs in other specialties depend upon how soon other forces are raised and on how soon those already authorized are placed in the field.

Judge Prouty Nails Another Delusion

"NO, SIR. I say it does not purport to represent what it could be reproduced for, but it was produced to show what it could be reproduced for, less depreciation." Thus Director Prouty, of the Division of Valuation, at a recent hearing held in Washington. "What does that mean?" queries Mr. Brantley for the railroad on trial for claiming value. "It means . . . that a certain part of the service value of a property had been used, and it has no relation to what you can sell it for or buy it for." *"No relation to what it would cost to reproduce the property?" "No."* More than a year ago Mr. Thelen told the Interstate Commerce Commission that the Railroad Commission of California, after years of floundering, had discovered that the cost to reproduce land was not the cost to reproduce land. Judge Prouty now extends the convenient theory to cover the entire physical plant of the railroad. Many and marvelous are the interpretations lawyers can give simple English when they put their minds to it!

New Water Sterilizing Agent Promises Well

AFTERGROWTHS of bacteria at the ends of long delivery conduits and in clear-water reservoirs are the bugaboo of the operator's life. He has a hard enough time explaining high counts to the officials higher up, but a still harder one to convince the layman public. Hence, a new germicide that gives promise of eliminating this troublesome feature, although a high count has not necessarily any particular sanitary significance, will be looked into most carefully. Undoubtedly, the experiments in this country at Denver (as outlined on page 210), supplementing and checking those at Ottawa, are being duplicated in other places. At any rate they should be before any wholesale discarding of chlorine apparatus is to begin, although the diversity of kinds of supply in the Denver system includes underground galleries, open algæ-infested lakes, river water, rapid and slow sand filters, hard and soft water. Trouble from tastes and odors has not been serious in Denver, but from the start the aftergrowth problem has come up periodically. The reduction in amount and elimination of oxidizing action on organic matter should tend to minimize, if not entirely solve, the taste and odor problem. The economics of the question are well worth studying more in detail, for undoubtedly the handling of two chemicals costs more than handling one. Whether the reduced amounts required will balance the added cost for labor, upkeep of additional equipment and stricter control by the chem-

ist, has not yet been determined. Surely, those superintendents who have not a skilled analyst to direct the work should go slow about stampeding for the latest method. Let the better-equipped plants with their expert chemists find the pitfalls first and show how to avoid them.

Low-Bid Letting Bad for Road Contracting

A MORE unfortunate situation than that in which many Eastern road contractors find themselves today would be hard to imagine. Yet these misfortunes are not so much the result of war and other unpreventable conditions as of sheer reckless extravagance and ignorance on the part of some would-be contractors.

The great mileage of road-paving work let during the past two or three years has caused many men, without previous experience in road building or even in contracting, with little or no financial resource, urged on by surety bond and material salesmen, to make bids at prices which could have yielded a profit two years ago only with the best and most efficient management. With an utter lack of such management, many of these contracts are unfinished today, and the continuance of the work is an impossibility at present prices.

A good example of how these conditions have been brought about is the case of a contract which was let two years ago to a man who had borrowed the railway fare with which to go to sign his contract, and it was known that a surety company representative there loaned him the money to make the trip and furnished the certified check which he had to deposit with his bid according to law. This so-called road contractor has built less than fifteen hundred dollars' worth of culverts, and has not graded or surfaced a single square foot of road on his contract in the two years, or even paid the first premium on his surety bond. Consequently, this piece of work, like many others, must be readvertised and relet at a price far in advance of that bid two years ago. The contractor who now takes the work knows that he cannot receive the extra money unless the state is able to collect it from the surety company, which will require years of litigation at the very least.

Coupled with the shortage of labor and material, an unusually rainy spring and early summer, and with nothing to bid on except these canceled contracts, road contracting in some regions is in a sorry condition. If any road contractors there are happy, it is only the few who have been employed on a salary basis to finish canceled road contracts as superintendents of state-paid day labor. There are instances of where the state has been able to do this work very efficiently by acquiring the services of such men and by paying them in addition a reasonable rental for their equipment.

The authorities are attempting to relieve the situation by every possible means within the law, but the fundamental difficulty lies in the manner of letting contracts to low but irresponsible bidders. This is the thing which is causing a more serious setback to road construction than any other single element in the present complex situation.

A New Idea and a Simple Tool Win in Bridge Erection

THE success recorded for the locomotive crane in the Steubenville bridge erection described in our issue of July 19 has the unusual character of being accomplished by simplification of method. Modern advances in bridge erection have mostly involved refinement of procedure, further specialization of machinery, in harmony with the increasing difficulty of the problems put up to the erector.

Thus, we are apt to look on the two biggest pieces of gantry-crane erection of the last few years—the Quebec work and the construction of the Ohio span of the Sciotoville bridge—as representing pretty well the highest point reached by the art. Yet the erectors of the Steubenville bridge eliminated the costly, cumbersome gantry in a case which by prior standards would have to be rated as an undisputed gantry job. Their achievement was due to a bold idea, not to a new tool.

Their locomotive crane, while powerful, heavy, and equipped with a very long boom, was quite the same as the small locomotive cranes that are doing so much loading, unloading and miscellaneous handling nowadays. Their erection method, then, involved the use of a simpler machine, a more all around tool, rather than a more specialized one. It would seem that we are still in a period of bridge erection where simplification and standardization have a good chance for success. Perhaps there are similar chances in bridge design.

In view of the high development which bridge erection had attained over a decade ago, it is interesting to note a distinct shift of expert preference. Some years ago the heavy derrick car was looked on with favor as the prime all around bridge-erection tool. But a little later the advantages of rotation and greater freedom of maneuvering possessed by the locomotive crane came to be appreciated by bridge erectors as they had earlier been recognized by erectors of light mill-building work. Today the field conceded to the derrick car is much reduced.

The derrick car still has advocates. Its superiority remains clear in cases where mobility and combined load and reach capacity—mainly forward—are decisive. But the Metropolis and Steubenville jobs proved the unsuspected adaptability of the locomotive crane used as a truck-mounted gin pole. At Metropolis the crane handled an erection job of unprecedented size, on falsework, in surprisingly fast style. The even greater surprise of the Steubenville cantilever work followed immediately after.

That these two pieces of work required a very large forward step in weight and boom length of the crane ought to be given due consideration. It was in making this step and being willing to risk highly important

work on its success that the men in charge displayed originality and courage. In the present state of the art it is safe to say that they pushed the method to its practical limit.

The Human Element Once More

IN TIMES like these, as this journal and its predecessors have pointed out before, the contractor whose organization is a big family, which he has taken care of through thick and thin, has a tremendous advantage over all competitors. Such contractors, however, are few. Not many have been able to command the capital on which such large dividends may be realized. Not all of these have sensed the possibility of thus gathering dividends. And it is too late now to begin building in this way for returns out of the present activity—the thin has passed and the thick is with us. But the prosperity of last year and the necessities of this for larger and faster construction in many lines should drive home to an increasing number of contractors the lesson that they must learn if they would survive in the day of greater efficiency which will succeed this period of stress.

It is not enough to have machines—men must run them. It will not answer to have only clever plans—men must execute them. It will not suffice to enter the field with heavy financial backing—the human element cannot be dispensed with. Yet, although the surplus of labor for construction has long since vanished, though competent foremen and able superintendents in most lines are as hard to find as hens' teeth, much can be done even today by every contractor who will begin by studying the needs and capabilities of those men he now has. What his present employees know about his methods—their experience acquired through his instructions—is an asset that should not be thrown away. It is worth trying to hold these men by studying their human relationship to the work and the organization.

For instance, is the interest of one of your timekeepers taken off his work by worry over what you think of him and what will happen to him when work slackens? Take a few minutes to tell him where he stands. Did you hear the master mechanic, the last time you were at the bridge, growling about an overfed, lazy pipefitter who could not stand up to a full day's work? And do you recollect what a howl the walking-boss put up about the scarcity of pushers? And did it occur to you that lazy men sometimes develop genius in keeping other people busy?

Not only must the individual fitness of men receive more attention, but the needs and standards of the workmen as a class must be looked into. Men may think that a bonus system is an attempt to get work out of them for nothing, that a well-conducted camp is a cover for an otherwise undesirable job, that reading rooms and Y. M. C. A. buildings and even "movies" are attempts at interference with their private conduct, if these things are done without careful study of the element for which they are meant. Needless to say, this involves a lot of work.

But if you can begin by picking a few "bosses" on your work for personality of the sort men like and respect; if here and there you can tie this man and that to your organization; fit a few workers now and then into places that suit them better; and build up a reputation for "looking out first and always for your crowd"—then even in these times you can select an organization that, well worth holding through the slack period to come, will reap big rewards for you from the activity that the world's recovery from the present strain of war will bring.

Railroads Should Be Low-Rate Water Customers—Sometimes

WATER-WORKS managers have cast longing eyes on the railway water-supply business. The railroads use lots of water and can develop their own service usually only at high cost; on the other hand, the water-works men are seeking new fields for profitable extensions affording more efficient utilization of their property in long-hour or off-peak service. And the railroads apparently are anxious to be courted—as favored customers, however.

A railroad man argued not long ago before a gathering of water-works men that railroads are customers who should be specially sought. The plan he proposed was low rates based on the operating-cost reduction that would follow if the railway customer, once secured, should again desert. Such an offer is justified under certain conditions, but if applied indiscriminately it will bring grief. Let us reason a moment.

The railroad promises to be a desirable candidate for low rates where the supply is pumped direct from source to customer and the whole water-works investment depends heavily on the peak drafts. If the railroad's consumption is in long hours of steady draft, so that the demand (and investment) costs are distributed over many hours' use, then the true unit cost of supplying the railroad is low and therefore the rates may be low. If the railroad can erect its own cheap and convenient storage tanks and draw water only at off-peak hours (commonly from 10 p.m. to 5 a.m.), a still lower rate is justified, for investment may not enter the unit costs at all.

But a railroad cannot equitably be so favored where a water-works captures a steady stream and impounds it against the hours of use. Then there is not a heavy investment in equipment reserved for peak-load customers. The total annual costs are properly distributed more in proportion to quantity of water supplied than according to maximum demand. The rate that is proper, under such circumstances, for the large, long-hour customers will ordinarily not differ much from that of the smaller short-hour customers; whatever difference there is can be attributed to the increased influence of meter reading, billing, office expense, and investment in service lines and excess size of mains.

It has been urged that the rate to a railway should be based on the slight reduction in operating expense that would result by dropping the road, since the all-important labor and investment cost to the water-works would not decrease at all and fuel and supplies would fall but little. But exactly that same effect would result if the *small* customers should quit in a body, or in a group of some size. Why not make their rate the cash sum spent out of pocket by holding rather than releasing them?

Homogeneous Organization Speeds Work at Ayer Cantonment

INTERNATIONAL FILM SERVICE

CONSTRUCTING QUARTERMASTER CO-ORDINATES MANY ORGANIZATIONS TO BUILD VAST CANTONMENTS

Wooden City Spreading Across 8000 Acres of Hills and Scrub at Rate of 40 Buildings a Day—Fourteen Sawmills Frame 275,000 Feet of Spruce a Shift—60 Trucks and 120 Teams in Use

TWO AND A HALF MILES from the Massachusetts junction town of Ayer, 8000 acres of scrub-covered hills which next September will be a wooden city of 40,000 population is today swarming with thousands of workmen, crawling with freight-cars, motor trucks and wagons, and alive with an activity which seems feverish to the observer, but which is in reality directed by some of the best brains America can furnish—those of her sons who have been trained to plan and build.

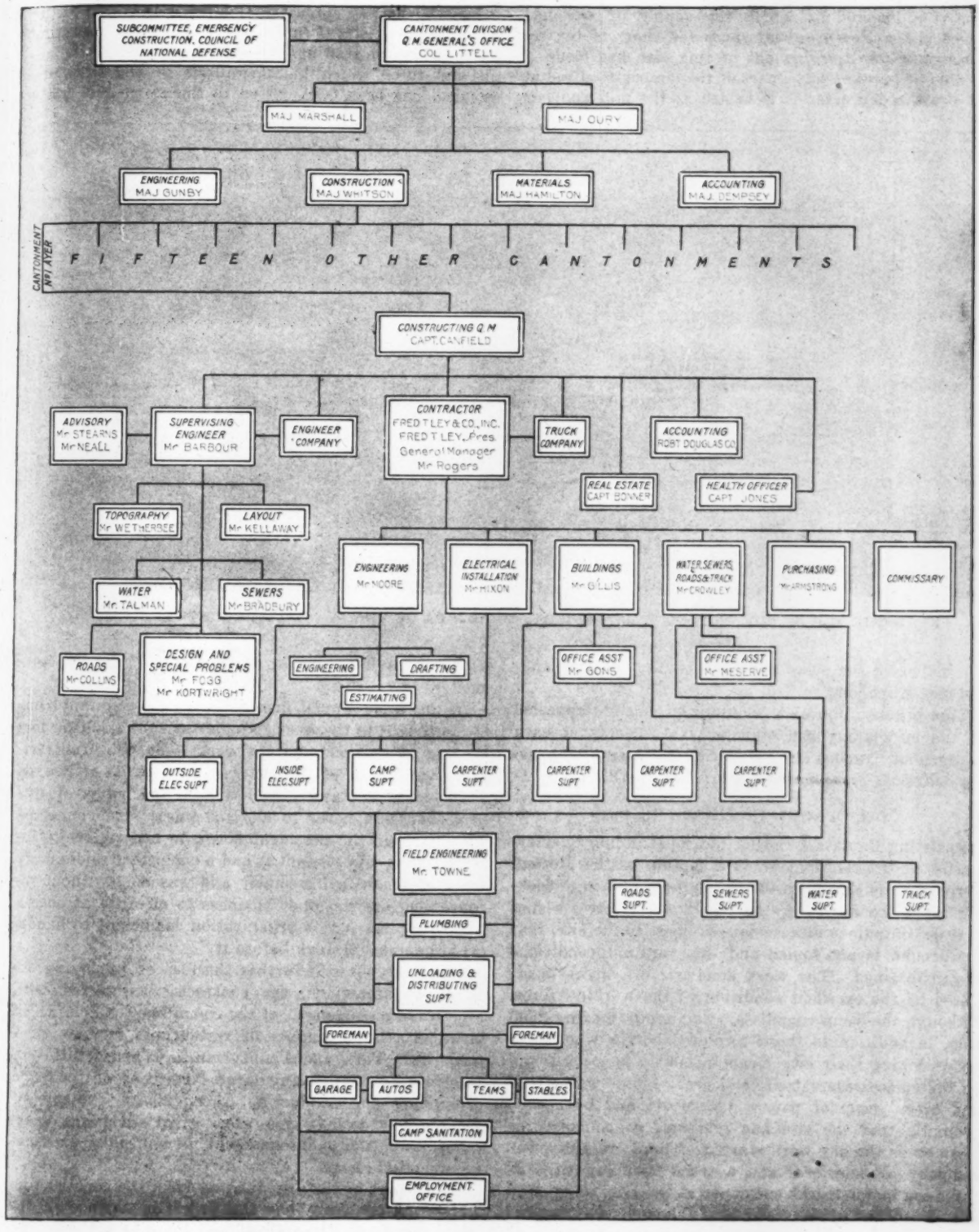
Within 75 days from the letting of the contract on June 18, this cantonment, Camp Devens, must be ready to house its quota of the National Army. Into its 1100 and more buildings will go upward of 16,000,000 ft. of lumber, which is being unloaded, framed, transported and erected at the rate of 40 carloads a day. Nearly 20 miles of highway will be ready for the feet of its soldiers, the wheels of their guns and transports. The engineering organization of its constructing quartermaster must design and lay out a water-works system of 2,000,000 gal. per day capacity, a sanitary sewer and sand filter system, and electric lighting and power circuits of 1200 kw. capacity.

The thousands of carloads of lumber, wood-stave pipe and tanks, sewer tile, paving materials, machinery, hardware and whatnot must be ordered with consideration for the sources of supply from which similar quantities are being drawn for 15 other cantonments of equal size. Only a central directing organization of the highest capacity, supplemented by the most efficient co-operation at the site, could carry through such a task at any time. Under present conditions, with the supply of most construction materials mortgaged by heavy general demand and with the country's railroad service so overtaxed that a shortage of more than 100,000 freight-cars has shown on the balance sheet for four successive months, the accomplishment of this task is a miracle. However, the miracle is taking place.

Central Office Tells Contractors Where To Buy

As shown in the organization chart, the central organization which is accomplishing this feat has at its head Colonel Littell, chief of the cantonment division of the Quartermaster General's office. Assisted by two majors and advised by the subcommittee on emergency construction and contracts of the Council of National Defense, Colonel Littell has under him four men of national reputation in their respective capacities who have been commissioned as majors in the Quartermaster Corps. The constructing quartermaster at each cantonment reports directly to this organization. He is in personal charge on the one hand of the civilian engineering organization employed at each site to adapt the standard plans to the location, lay out the work, design special features required and inspect the construction. On the other hand, the contractor's organization is directly responsible to him, as is also the auditing department.

To arrange for the purchase of materials so that the 16 contractors would not be bidding against each other for the same supply, so that materials produced near each site might be utilized to the fullest extent and all supplies so routed as to avoid throwing too great a



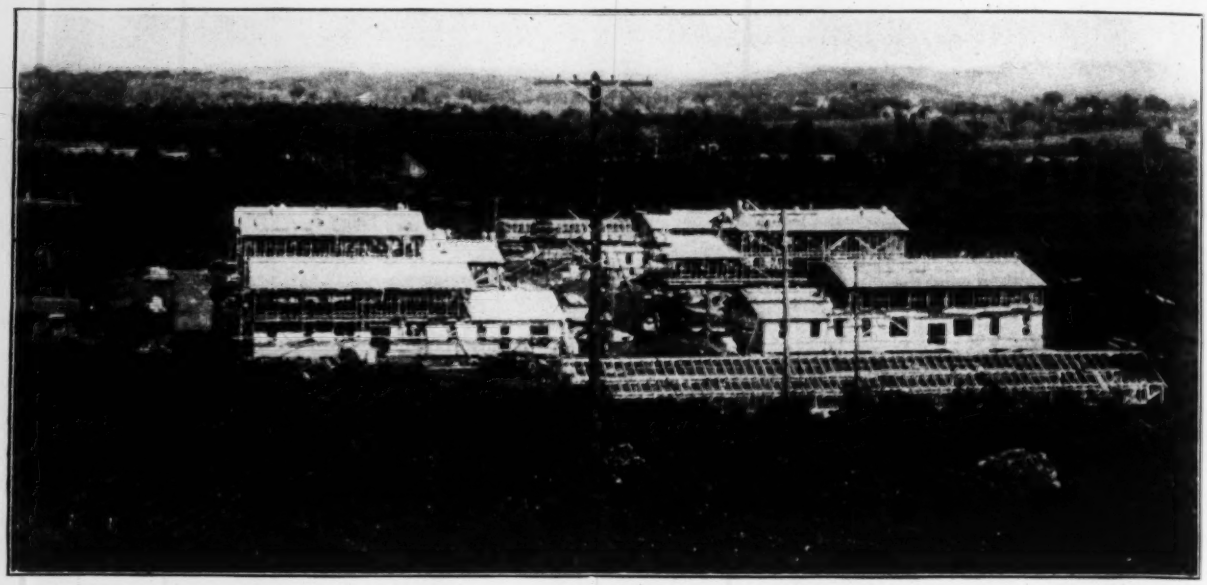
DIFFICULT WORK OF CONSTRUCTING ARMY CAMPS CO-ORDINATED BY STRONG ORGANIZATION

burden on any one transportation system, has been the task of the central office. Finding that, in the present state of the steel market, to attempt the exclusive use of cast-iron pipe for water mains would be to court delay, this office directed the purchase of wood-stave pipe with cast-iron connections.

To avoid the serious difficulty of transporting Southern pine through the badly congested territory between New York and Buffalo, the central office directed the purchase for the cantonment at Ayer of the slightly more expensive Northern spruce. With the exception of 5,000,000 ft. of dry pine boards obtained in the Caro-

linas, the amount by which the supply of seasoned spruce in the New England yards fell short of the requirements, the carrying out of this plan has made it possible to deliver a large part of the lumber required at the site the day after it is loaded at the mill and has

organizations. In pursuit of this policy the engineering work has been placed in charge of a Boston consulting engineer, whose staff and associates, assisted by the additional force which the magnitude of the work demanded, has been transported to the camp and estab-



FROM THE TOP OF THE CONTRACTOR'S OFFICE A GOOD IDEA OF THE SCRUB-OAK COUNTRY IS GAINED

eliminated all the delay and confusion of tracing long-distance shipments.

This organization also takes up all matters appealed by the purchasing and transportation agents at each cantonment, tracing and expediting shipments, improving deliveries from manufacturers and the like.

Job Organization Harmonious

Assisting Captain Canfield, the constructing quartermaster at the cantonment, is a captain of the Medical Corps, who is charged with the important task of looking after the health of the construction force, seeing that no contagious diseases are brought to the site, that the ground is not fouled and that sanitary conditions are maintained. The work done by this officer is attested by the excellent condition of the working force. Although the camp commissary is already feeding 2500 men, in addition to those foreign laborers who insist upon cooking their own meals, not a fly is to be found on the entire reservation; and every bit of waste food and every scrap of paper is collected and burned so promptly that the site has remained continuously as clean as on the day work started. There are also a full company of engineers and a truck company with 33 three-ton motor trucks encamped at the site. The engineer troops are at the disposal of the medical officer and of the civilian engineering organization, while the truck company is assisting the contractor in transporting materials, besides supplying the wants of the headquarters staff and of the troops at the site.

The effective coöperation of the entire construction force is attributed to the application of the principle which Mr. Balfour is said to have urgently advocated on his mission to this country—that of utilizing existing

lished at the headquarters of the constructing quartermaster.

In the same way a firm of Boston accountants has been brought to the work to undertake the auditing and keeping of records. As the work is done by contract, the organization of the contracting firm is, of course, available as it stands. It has been the policy of this firm for years never to allow a single man connected with it, from the president down, to become really indispensable. As a result it had a competent understudy for every man in its employ and was able without inconvenience to its other business to mobilize at once a complete construction organization competent to handle even the unusual work before it.

Following out still further the idea of employing existing organizations, the contractor associated with him in the management of the commissary a firm which operates a large number of restaurants in New England, New York and Pennsylvania. The facilities of this firm for purchasing large quantities of food and organizing and conducting a commissary capable of feeding 4000 to 5000 men are a great advantage, making possible the maintenance of an unusually excellent construction camp.

Every part of the organization from the constructing quartermaster down has the fullest confidence in the other divisions of the force, and there is not apparent a single point at which duties overlap or work is being duplicated.

Of the six divisions of the engineering department shown on the chart each has its own field parties and office force, with the exception of the last, whose duties naturally require little fieldwork. More than 75 men all told are included in this organization, counting the

parties drawn as required from the engineer troops at the site.

The first work of the engineering force was to produce a topographic map on a scale of 200 ft. to the inch, showing 10-ft. contours. In spite of the undergrowth, which was 6 ft. high over most of the tract, this survey was completed and the map made in the incredibly short space of two weeks. On the map was located the layout shown in the drawing, which took care of all the units required by the standard cantonment plans. A more accurate topographic survey is being completed as rapidly as possible, taking contours at 2-ft. intervals, to furnish the basis for accurate design of the drainage and road systems. Meanwhile, the work of laying out the buildings, water lines, sewers and such roads as are immediately needed is being taken care of.

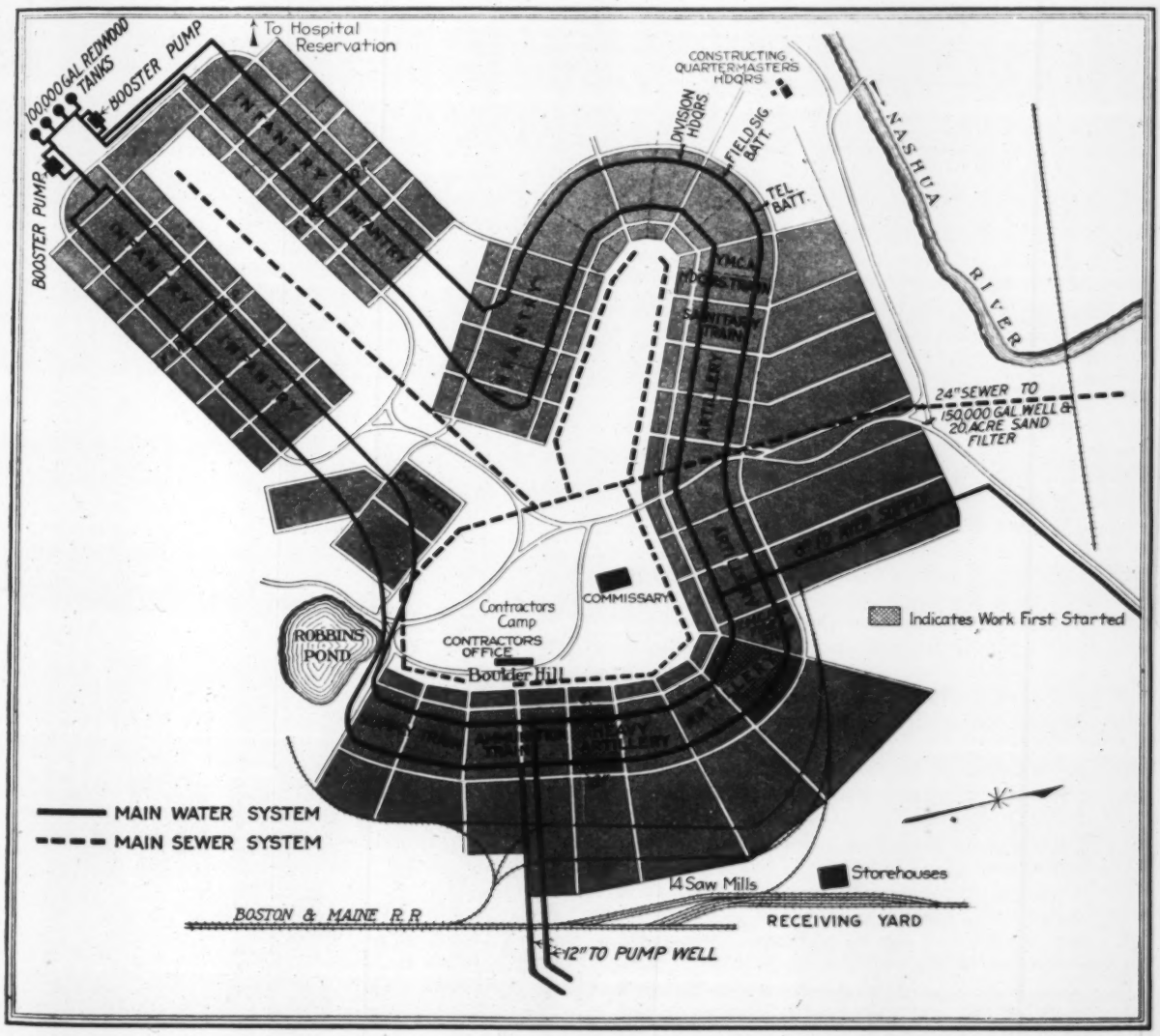
The urgent necessity for the completion of the cantonment required that almost every phase of the work be started at once, and the layout and survey parties are kept extremely busy. Their time is saved to a great extent by placing at the disposal of the engineering force a number of light automobile trucks of a city-delivery pattern, with which men and instruments can be quickly moved from place to place. Four-man parties are the rule, and 10 to 12 of them are in the field continuously.

The first problem with which the contractor was confronted was the assembly of all material and equipment at the site in the shortest possible time. This firm's general purchasing agent, in close touch with available markets, placed orders for staggering quantities of materials as fast as approved schedules could be forwarded from Washington. His office diary for the first two weeks of the work exhibits a significant monotony. Entry after entry reads:

"June ——. Received authority from Washington to buy ——."

"June ——. Bought ——."

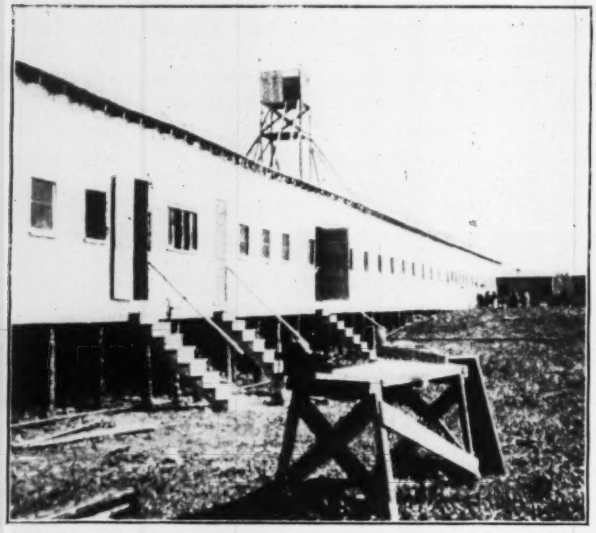
Not an order on the list but was placed within a few hours after the receipt of the approved schedule. In



STANDARD CANTONMENT LAYOUT LOOPED INTO ROUGH FIGURE EIGHT TO FIT IRREGULAR TOPOGRAPHY

the matter of spruce lumber alone, 22 saws scattered throughout New England were cutting material for the cantonment on the day following the award of the contract. Before July 1 the average daily total of lumber received at the site had risen above the required 30 cars.

A remount station, which is to handle, train and supply medical attention to at least 5000 horses, has



CONTRACTOR'S OFFICE WAS BUILT IN A DAY.

been added recently to the design. This will consist of paddocks, runways, veterinary hospital, horseshoers, school and such other accessories as are necessary for the care of horses in the field.

Put Up 23-Room General Office in One Day

The vanguard of the contractor's forces reached the site on June 18, and on the following morning a double telephone switchboard was set up on scaffolding surmounting the eminence known as Boulder Hill, near the railroad yard. While trunk lines to Springfield and Ayer were being connected to these switchboards and the two operators got to work, a general office building 36 x 306 ft. began to grow around the platform. Before night it was walled, roofed and floored. By noon next day it was completed. This building contains an entrance lobby, a central corridor, two lavatories and 21 office and drafting rooms.

The lumber for this building and to start the contractor's camp was bought out of stock from near-by yards and delivered to the site almost immediately after placing the orders. The contractor's temporary camp, the location of which is indicated on the drawing, was started at the same time and pushed quite as rapidly. Work was slowed down in a few days after a housing capacity of approximately 3000 had been reached, as it is impossible to develop the work to the point where the full quota of 5000 men can be profitably employed during the first few weeks.

The classification yard of the Boston & Maine R.R. at one side of the site was already overtaxed, and it was necessary immediately to build a new yard. For receiving and unloading materials, the Boston & Maine built seven tracks averaging 2000 ft. in length, and in addition the contractor has under construction spurs and sidings totaling more than four miles. Two of these spurs, partly encircling the site, may be found useful later in supplementing the motor-truck transportation of sawed lumber.

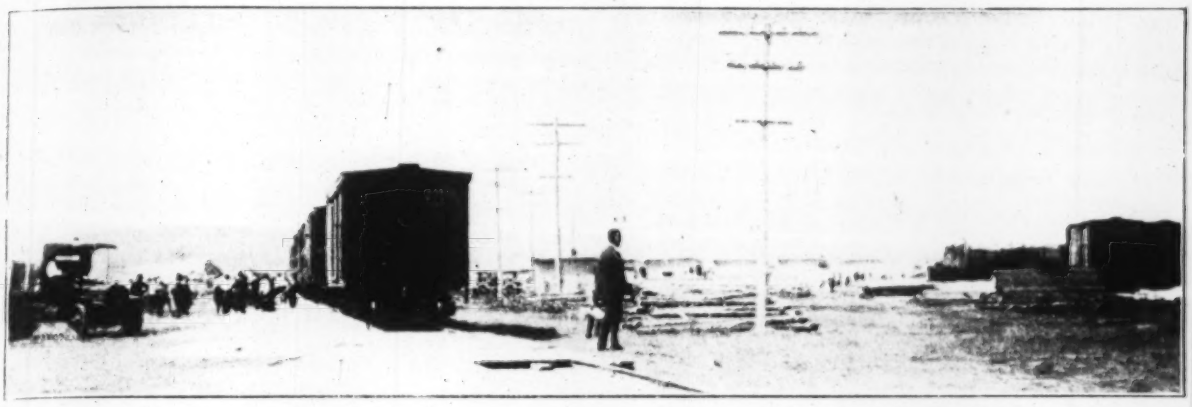
Second-hand rails for the lines built by the contractor were not to be had from any railroad or contracting firm in New England. Nevertheless, it required but five days to lay down at Ayer all the rail needed. The contractor's purchasing agent, after failing to locate a nearer supply over the long-distance telephone, came to New York, walked with representatives of several railroads from Weehawken to Communipaw in Jersey City, and before reaching the end of his excursion had bought the tonnage of rail required. Not only the rail, but a sufficient supply of the odd fishplates needed to connect the varied weights and sizes, were delivered to the job before the local force was ready for them.

Fourteen Saw Mills Frame 550,000 Feet a Day

Carpenter labor is difficult enough to secure at this time, and practically all framing by hand has therefore been eliminated. Although Ayer is technically in the Fitchburg district, the Boston market for labor really governs the work, as practically all the men must be drawn from there. To keep these men continuously busy on progressive work, it is the object of the contractor to unload lumber scheduled for the buildings under way, frame it at the siding, load it on motor trucks and deliver it to the site without ever letting it touch the ground. For this purpose 14 sawmills and a clipper with a capacity in two 8-hour shifts of 550,000 ft. are provided.

At the start of the work, of course, deliveries of anything that was ready to ship had to be accepted, the material that was wanted for the buildings under way could not always be got at without unloading other cars, the storehouses at the siding were under construction as well as the sawmills themselves and other temporary buildings, and it was not until the first week in July,

FOURTEEN OF THESE MILLS FRAME HALF A MILLION FEET DAILY



"IT IS HERE THAT THE WORK SWARMS WITH MEN"—HALF A DOZEN OF THE SAWMILLS SHOWN IN THE CENTER

after 10 of the mills had been set up, that this organization was going smoothly. Throughout the work it is expected that perhaps a third of the lumber will have to be piled before being sawed, and handled twice.

It is here that the work swarms with men. All the lumber unloaded must be passed through the mills and tallied whether worked or not. Moreover, at one end of this yard are the main storehouses, while at the other four blacksmith shops, the main garage and the fire station form another busy center.

Motor-Truck Transport System Covers Site

At fast as it is cut, the lumber is loaded into motor trucks and wagons forming a long line on the side of the sawmills away from the yard. In addition to the 33 army trucks, which are Kelly-Springfields, the contractor has already at the site 17 large trucks, 10 of which are Duplex 4-ton trucks with 6-ton trailers, enabling each unit to handle 10-ton loads. Small supplies, tools and often gangs of men are carried around the work by 11 light Overland trucks. The trucks are, of course, loaded by hand. The large number of laborers employed, however, makes the process very rapid. The trucks are supplemented at present by 120 teams, which can transport from 1½ to 2 tons at a trip.

Naturally, the first work started was on the buildings in two of the units nearest the railroad yard. This start, indicated on the drawing, will make it possible to carry the work in both directions around the main circle and has also given the contractor an opportunity to complete some of the road grading, so that the more remote parts of the site may be reached without at the same time sacrificing any speed on the immediate work started.

Trenching Machines and Steam Shovels Busy

The grading is being done with three revolving steam shovels of ⅝- and ¾-yd. size. They are being assisted in some of the grading necessary by a pair of Keystone excavators. Hand labor on installing the water and sewer systems is also being saved by three trenching machines of different patterns. For the most part these machines operate with considerable speed, but in a few places boulders and large roots which could not be blasted out have made handwork necessary. The soil is porous sand and gravel with a sufficient mixture of clay to make it stand for a short time after a trench is opened. In many parts of the field, however, sheeting is required in sewer trenches.

A few thousand yards of concrete at scattered locations will be required. The chief items are the lavatory foundations and floors, and the intake well for the water system. This latter will be built in a wood sheet-pile cofferdam, as it is 50 ft. in diameter and extends 30 ft. down to a stratum of water-bearing gravel. Seven concrete mixers are on the site.

Temporary Water-Supply from Ayer

At the time the site selected was under consideration, the civilian engineers now engaged at the camp conducted a test to determine whether the source from which Ayer draws its water-supply would be ample for the needs of the far larger camp. The Nashua River was not considered as a source of supply, because of known pollution. The town of Ayer pumps its water from a number of driven wells, which reach a stratum of water-bearing gravel 25 ft. below ground surface at a point north of the camp. Additional pumps were secured, and the normal drain on these wells of less than 300,000 gal. a day was increased by more than 1,000,000 gal. without lowering the water table to any appreciable extent.

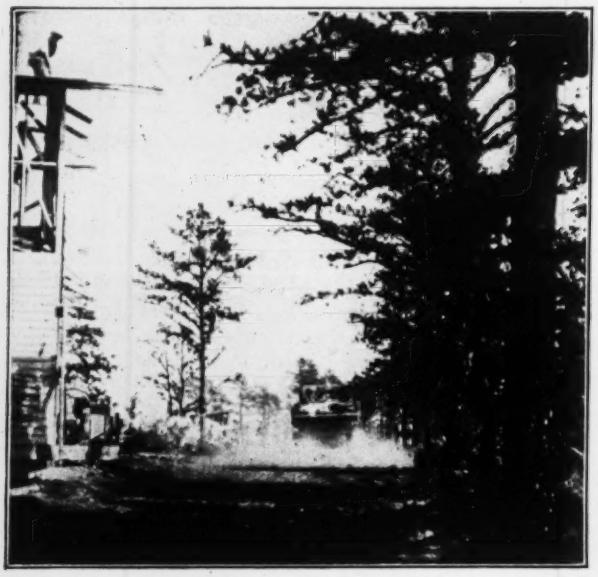
It was decided on the basis of this test that the Ayer system could supply the camp during the construction period and that the stratum of gravel tapped would be ample for the needs of the cantonment. It is planned to construct a well 50 ft. in diameter and 30 ft. deep, beside which the electrically driven pumping units for the camp will be installed. These pumps will deliver water to four 100,000-gal. redwood stave tanks, through a pair of 12-in. mains. Both these mains and the 8-in. line to the Ayer water system connect into a double line of 8-in. mains circling the camp, from which the supply from the various units is drawn and which is connected to the tanks.

The normal head from the tanks on the greater part of this distributing system is about 150 ft., to which, for fire service, 60 ft. will be added by means of a booster pump located on a bypass on a 16-in. main between the tanks and the distribution system. Should the demand draw down to any extent the water in the 50-ft. diameter well, additional wells will be sunk in the same general neighborhood and water siphoned to the original well.

In addition to the fire protection thus afforded, the cantonment will have a complete fire department, one of the chemical engines belonging to which is already at the site for the protection of the work during construction.

Sewage Disposal by Sand Filtration

Collecting sewers will circle the camp in a similar manner to the layout for the water mains and deliver sewage to a 24-in. main, extending to a 150,000-gal. pump well near the Nashua River east of the camp, from



TRUCKS SCATTER CLOUDS OF DUST

which a 4,000,000-gal. pumping unit will raise it and distribute it over 20 acres of natural sand filter beds.

The land acquired at the site of the water-supply and for the filtration beds, in addition to 1000 acres or more north of the camp, where a hospital is to be built capable of accommodating 2% of the force at the camp, will run the total acreage of the reservation up to 10,000.

The entire reservation will be circled by electric light and power lines, carried on poles, which will provide for a maximum lighting load of 800 kw. and for a power load for the pumps of 400 kw. additional. This current will be supplied by the New England Power Co., which is constructing an 8-mile 66,000-volt transmission line from Leominster to the cantonment. A temporary line is already in use for lighting the construction work, driving the contractor's saws and running his pumps.

Contractor's "Officers" Are Mounted

To cover the wide range of territory at the camp site, the contractor's manager and general superintendents as well as the chief engineer and any visiting officers of the company are provided with automobiles, at least 15 of which are in constant use. In addition, several of the labor foremen and others are mounted, 14 saddle horses being kept on the work for this purpose. While it cannot be said that automobile riding over the roughly graded and as yet unpaved roads and through the brush is an unmixed pleasure, three sprinkling wagons are kept in continual use to mitigate the dust as much as possible.

Substantial progress is being made at the work. On July 30 there were 399 buildings under construction, a large percentage of them closed in; the main outfall sewer was built, and 60% of all the sewer work was completed. There were then 6400 men at work at the site.

The work at Ayer, as stated, is under the direction of Colonel Littell's office, with Capt. Edward Canfield, Jr., in local charge. The duties and relations of the other firms and individuals concerned is best grasped by a study of the accompanying organization chart.

Segment Block Sewer Fails

Two Breaks Occur in 4-Foot Sewer Near Manholes—Thought To Be Due to Poor Shaping of Bottom of Trench

By Seymour U. Misner
Civil Engineer, Fort Wayne, Ind.

TWO BREAKS occurred recently in a segmental block sewer completed in the winter of 1915. The sewer is circular, 4 ft. in diameter, and is a combined trunk sewer. On June 27 about 14 ft. of the sewer showed failure, the ground above being washed into the break and channel, leaving a hole about 17 ft. deep, with sloping sides. A catchbasin was partly uncovered and its outlet pipe found to have been washed into the break and covered by the earth washed in. The failure occurred at the point where the catchbasin entered the segmental block sewer. On June 30 a second failure occurred in this same sewer about 1000 ft. below the first break. This break occurred on the downflow, or west, side of a brick manhole. The manhole itself was left standing, fully exposed on the west. Leading into the north side of the manhole is a 15-in. vitrified-clay lateral, still intact, although it is partly exposed for 14 feet.

BREAK IN SEGMENTAL BLOCK SEWER

My first theory as to the cause points to a common occurrence in sewer work. It is that the digging was done with a trenching machine and care was not exercised in shaping the trench bottom so that when the segmental blocks were placed they would have a firm and sure foundation. Loose dirt was placed behind the lower quarters and tamped sufficiently to hold the blocks in place until the circle was completed. When the arch was brought to a closing at the top, the lower quarter had settled and the sides bulged out, creating a space of several inches at the top of the sewer. The result was a flat-roof sewer, poor cement being flushed and placed in the voids and joints.

The sewer in the vicinity of the two breaks is built across and parallel to a ditch that after a rain has its banks flooded.

No damage to property resulted from the breaks.

Engineer Ousted as City Manager of Portsmouth, Va.

Council Interferes with, Then Discharges Manager—Citizens Protest—May Recall Council—Manager Makes Statement

AFTER six months' service as city manager of Portsmouth, Va., Tyrrell B. Shertzer, an engineer of 16 years' experience, mostly in municipal work, was discharged by a 5 to 2 vote of the city council. This action was taken on June 25, to become effective on July 31. The council has been severely criticized at two mass meetings, one of which voted to request the council to rescind its action and also decided to start a petition for an election to vote on a recall amendment to the city charter, as provided by statute, in order that the people may have a chance to turn the majority of the council out of office. A public protest against the action of the council has been issued by Mr. Shertzer.

City-Manager Plan Not Followed

The council is said to have organized last September on a departmental basis. It was a long time in selecting a manager. Mr. Shertzer was chosen after many applications had been received as a result of advertising in the technical press. He took office on Jan. 2, at a salary of $4000 a year. Although the general statute under which the voters declared for the city-manager plan distinctly provides that all executive power shall be vested in the city manager, and notwithstanding an adverse written opinion from the city attorney, yet the council, Mr. Shertzer says, has "persisted in maintaining" its departmental organization and has continued to insist that it "have a voice in all of the details of the administration of the city affairs."

The resolution removing Mr. Shertzer from office, which was adopted in executive session (against the law, it is said), was as follows:

"Whereas, it appears to the Council of the City of Portsmouth that T. B. Shertzer is not familiar with the needs and urgencies of the City of Portsmouth and is unable to satisfactorily handle the municipal affairs of the city, therefore be it resolved by the Council of the City of Portsmouth, Va., that the services of T. B. Shertzer as City Manager be dispensed with on and after July 31, 1917."

The City Manager's Side of the Case

The following extracts from a public statement issued by Mr. Shertzer tell a part of his side of the case:

"I came to this city on Jan. 1 a total stranger. I did not know a single man, woman or child in it. I had never been in the city but once before and then only for one day when I came on invitation of the council when it was considering the various applicants for this position. I had absolutely no knowledge or information as to existing conditions, finances or plans. Since my arrival and assumption of office, however, I have discovered a most involved and chaotic financial condition, uncared for streets, a loose system or rather lack of system in collecting trash and garbage, a disorganized street-cleaning force, a disorganized police department, a disheartened and disorganized fire department, general looseness of methods in all of the city offices, each one working for itself only and irrespective of what other offices were doing, each office and department making its own purchases when and how it pleased, no system for promptly auditing bills and paying them promptly so as to take advantage of discounts, and a thousand and one things of similar nature. There was a total lack of system and coördination throughout the entire municipal machinery. I have been working single handed with this condition and now am charged with the statement 'is not familiar with the needs and urgencies, etc.'

Some of the Things Done in Six Months' Time

"Since Jan. 1 I have reorganized the Police Department and have recently been advised by neighboring officials and the various railroad officials that Portsmouth now has the most efficient police department of its size in this section. I have purchased an entirely new and up-to-date equipment of motor fire apparatus and have made financial arrangements whereby the cost of it will be met in 7½ years by the difference in the cost of the maintenance of the antiquated horse-drawn apparatus and the motor apparatus. I have standardized all of the city supplies, purchasing them through a purchasing agent on bids only and issuing them to the departments and offices only on requisition. Notwithstanding the higher cost of all items, I have effected a saving of between 20% and 25% in this way on supplies.

"I have standardized the method of auditing and paying bills so that we have no 'running accounts' and all bills are settled weekly. I have instituted a vigorous campaign for collecting taxes and license fees so that more has been collected so far this year than in any corresponding period in the history of the city. I have so improved the methods of street cleaning and the collection of trash and garbage that notwithstanding the fact that the equipment cost is one-third more than in the past yet over 50% more work is being done at a unit cost of less than two-thirds of that in the past. These are some of the things which I have done since assuming office, and I state them only to offset the charges in the resolution.

The Whole Move Is Political

"I am a graduate civil engineer with over 16 years' experience, the most of which has been in municipal work. This whole move is political and I feel that unless a true statement of conditions as I found them, of what I have done in the face of opposition and lack of coöperation, not only on the part of the majority of the members of the council, but also on the part of many of the present city officials, is made that a garbled report of the council action will be spread broadcast and do me great injury in the future.

"At least one of the members of the original council was, so I am informed, one of the most strenuous opponents of the adoption of the city-manager form of government; and after the people had voted to adopt this form, the political machine of the city concentrated its efforts to get him on the council with the avowed purpose of doing all within his power to discredit it. Of this fact I have no first-hand personal knowledge, since it all took place long before my arrival.

I have, however, been so informed by many of the most substantial citizens, and his actions since I have been here bear out the charge.

COMPLEXION OF COUNCIL CHANGED SINCE ELECTION

"The complexion of the council has changed completely since its election, as one of the original members has died, a second was forced by ill health to resign and a third resigned partly for business reasons and partly from disgust. These vacancies took place at various times; and as the law allows the majority of the remaining members to fill vacancies for the unexpired terms, advantage was taken of the absence of one of the members at one meeting to fill the first vacancy with a man who was favorable to the opposition, thus giving them a majority. The filling of the other two vacancies with men unfavorable to the city-manager plan was then easy, so that now the line-up of the council is five against the plan and two for it.

"This fight and my dismissal, I am confident, is not so much a fight against me personally as it is an effort to discredit and belittle the form of government. Some of it, however, is directed at me for my refusal on several occasions to be blindly led into doing things against my better judgment. The fact that I dismissed the brother of one of the members from the police force for leaving the city without permission and for going on a two weeks' spree did not endear me."

No Yellow-Legged Engineer Could Build Him a Dam

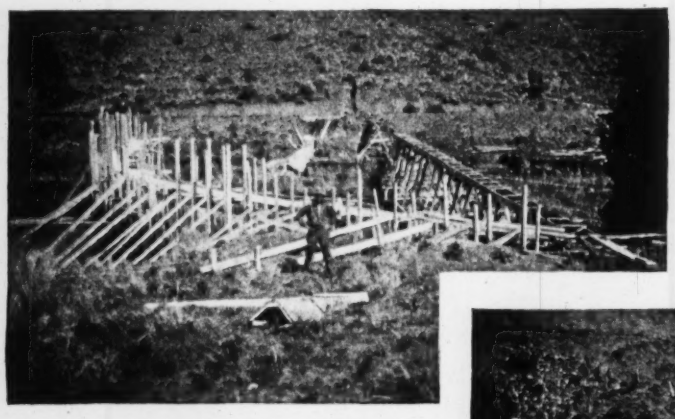
Western Rancher Disdained Asking Expert Advice and Went Ahead with Disastrous Results

SOME amateur engineering with the usual result is shown in the story of an irrigation dam recently started, and very soon after stopped, in a far Western state. Somewhat over a year ago a rancher decided to store water for irrigation purposes on his own ground and chose a site at the lower end of a steep, narrow gorge carrying a stream of substantial flood-water flow.

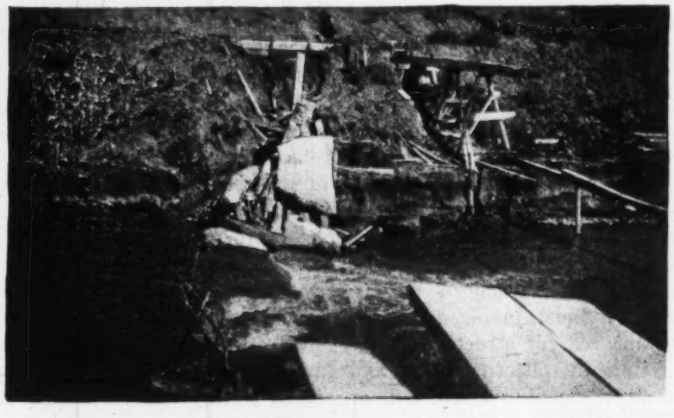
The structure was of reinforced concrete, curved upstream, with reinforcing of old railroad iron laid horizontal, none vertical. The thickness was to be 18 in., bottom and top, and the length along the crest about 250 ft. The intended height is problematical, but was probably twice that reached. "Anchoring" the ends consisted of digging a shallow trench a few feet into the dirt hillside. The foundation work was a trench three or four feet deep in the gravel stream bed. There was no attempt at reaching bedrock.

When the dam was started, the water master of that district strongly advised against its continuance under the plans the owner was seen to be working upon, and told him to consult an engineer and obtain the approval of the state engineer. The reply was that he had constructed a concrete livery stable at Spokane, and no yellow-legged engineer could show him how to build a dam.

When the structure had reached a height of about 15 ft. above the stream bed (as shown by the standing portion in one of the views), the water master ordered the work stopped. A few days later the water rose several feet in the creek, a mere starter on what would come with the spring flood, and a large section of the dam was carried away, as shown in the other view. What is left is really of negligible value!



CONCRETE ARCH DAM 250 FEET LONG AND 18 INCHES THICK ALL THE WAY UP IS BEING BUILT BY RANCHER WITHOUT ENGINEERING ADVICE



WHEN THE DAM WAS ABOUT 15 FT. HIGH, ONLY HALF THE HEIGHT INTENDED, THE FIRST RISE IN THE RAPID RUNNING STREAM WASHED IT AWAY

All Cleveland United in Good-Paving Campaign

Evidence Is Convincing That Getting the Public Interested in Municipal Engineering Pays Abundant Dividends in Better Work

MAYOR LAYS FIRST BLOCK IN REPAVING EUCLID AVENUE

Civic League and Cleveland Engineering Society Play Large Part in Execution of City's Definite Plan for $10,000,000 Program

By NATHAN C. ROCKWOOD
Associate Editor, "Engineering News-Record"

DOES IT PAY to help the public comprehend the engineer and his work? What has publicity for engineering accomplished? Study Cleveland's repaving work and you have an answer which bids fair to mark an epoch in the betterment of municipal engineering. If the program already well begun is carried out in the spirit of its inception, the street-improvement work of Cleveland will form a model precedent for American cities.

The engineers of Cleveland through their active Cleveland Engineering Society have been pioneers in engineering publicity. They have set the engineers of the country an example of public spirit, they have devoted some of their energies to wider and more comprehensive things than professional discussions, they have worked for civic betterment—and their labor is bearing fruit.

When the citizens of Cleveland voted $3,000,000 to pay the city's share in a $10,000,000 street-paving, repaving, resurfacing and repairing program, the engineers of the city set about the task of insuring the city the best results the money could buy. How much their previous work in engineering publicity affected the success of this task no one can definitely state, nor can one deny that the unprecedented development in Cleveland today is in no small degree the fruit of that broad-minded outlook on engineering.

Plan for Municipal Paving Commission Failed

The first plan to give the public an interest in the work and a real insight into how the money was being spent was to have the mayor appoint a commission of public-spirited engineers, which was to coöperate with and assist the city engineering staff and serve without pay. This plan was agitated by the Cleveland Engineering Society and was accomplished, but the city fathers neglected to confer any powers on the commission, and it died in infancy.

The engineers of the city then coöperated with and assisted the Civic League of Cleveland, a well-established and exceedingly useful organization working for cleaner local politics. A paving committee of the league, consisting largely of engineers and headed by J. W. Frazier, president of the Frazier-Sheal Engineering Co., was appointed, funds for carrying on inspection work were raised and an engineer and inspectors were appointed.

Organization of Cleveland Paving Work

Paving work in Cleveland is done through a Department of Public Service, in which is a commissioner (chief engineer) of engineering and construction and a commissioner of streets. The former has charge of all new construction, the latter of all repair work. Each is independent within his own sphere. All subordinates are under civil service.

The commissioner of engineering and construction is Robert Hoffman, who has been head of the city engineering department for several years. His deputy in charge of pavement construction is F. R. Williams. The work under Mr. Williams (more than 100 contracts) is handled through a chief inspector and his staff of 45 inspectors; one field assistant engineer, who has the supervision of four field parties; an office assistant engineer, who has charge of the office force; and an assistant engineer in charge of sidewalk construction.

The extensive amount of repaving to be accomplished called for careful planning. It was desired to carry out the whole program in three years. The work was studied with the view of doing the work most needed first, of providing certain principal through routes with continuous good pavement as soon as possible, of preventing the tearing up of all the streets in one locality any more than was essential to economic construction, and of utilizing old pavements as far as possible. It was desired to do $2,500,000 worth of work during the present year, but labor and material shortages will probably cut this to $1,500,000.

Three General Types of Pavement

The larger part of the new pavement work is of three general types—for the heaviest traffic either Medina sandstone on a 6-in. concrete base and a granulated slag cushion, or creosoted wood block on an 8-in. concrete foundation, and for other streets chiefly some form of

brick pavement. Specifications are provided for granite block, but granite has never been able to compete with Medina sandstone in this locality. The Medina sandstone blocks are more irregular than the first-class granite blocks used for the paving of Eastern cities, but wear smooth and make an excellent grouted pavement. In some instances the old blocks are being relaid, but the general practice is to require new blocks.

The creosoted wood blocks are long-leaf yellow pine treated with 16 lb. of either coal tar or distillate oil,

EUCLID AVENUE, CLEVELAND'S PRINCIPAL STREET, BEFORE REPAVING—REPAVING STARTED ON FAR SIDE

according to the usual specifications requiring a supplemental vacuum preceded by or followed by a short steaming period. Wood-block pavement is being laid on Euclid Ave., the city's principal business and residence street. A large part of all residence streets is paved with either monolithic brick or brick laid on a sand-cement bedding. Probably Cleveland is the first large city to adopt the monolithic brick construction extensively. There are one or two short stretches of two-course concrete pavement to be let, and some asphaltic concrete, including bitulithic. Some of the older pavements are being resurfaced with 2 in. of tar concrete. These comprise all of the types of pavement being used in Cleveland today. The selection of the type is a matter of some study, but no extensive investigation or research has been made. Brick has been the popular pavement in Cleveland for many years, and by far the most streets have always been paved with this material.

There are generally two inspectors on each brick paving job, one to inspect concrete and the other bricklaying. As many as four inspectors to a job are sometimes employed. These inspectors report to the chief inspector, who is responsible only to the paving engineer. The inspectors in general are of the usual city-pavement-inspector type and are not technically trained men.

Civic League Has Independent Inspection

The Civic League, through its paving engineer, H. P. Cumings, has established an inspection bureau which follows the work very closely. The paving engineer spends a considerable part of his time on inspection work, and two inspectors (formerly three) are constantly on the work, each paving job being visited by them at least once a day. They keep daily tab on how the work is being done, whether the specifications are being lived up to, whether the subgrade is properly prepared, whether the concrete is good or bad; but not the least of their tasks is to see whether the city inspectors are on the job and how efficient they are.

Colored charts on cross-section paper have been devised whereby the paving engineer keeps accurate track of each day's operation on a contract. A system of letters and figures is used by which he knows which of the city paving inspectors was at work that day, which of his own inspectors visited the job, and the character of the work being done. All this is shown at a glance by a color scheme, each chart covering an entire month and 20 or more jobs. The league's inspectors make their reports on loose-leaf notebooks, and the original data are, of course, kept. The city's inspectors are rated by the Civic League's inspectors on their general bearing toward the work, whether they are civil or surly, whether they are sober—in fact, a rather close tab is kept on their ability to do their work.

Moral Effect of Civic League's Inspection

The moral effect has been considerable. While the attitude of some of the city inspectors was at first antagonistic, most of them have accepted the situation in the proper spirit and have exerted themselves to make good. It has accomplished something which probably the city engineering department could not have accomplished in promoting efficiency and honesty among its inspectors. The Civic League has brought about the dismissal of at least one incompetent city inspector and has been very influential in bringing about the proper performance of their duties by the others.

In dealing with the higher city officials, the engineer of the Civic League has shown the diplomacy, tact and professional courtesy which are essential to proper co-operation. While public criticism is the one compelling force by which the Civic League is able to accomplish its work, it is never used until the matter under criticism is taken up with the city officials and they are given an opportunity to defend it or correct it, as they see fit.

There was a tendency at the beginning for the newspapers to make political capital out of whatever criticism the Civic League should make of the city engineering administration. The engineer of the Civic League soon put an end to this idea.

So far the work of the Civic League has not extended beyond the inspection work already under construction, but it is intended in another year to widen its activities.

to making its influence felt in the selection of types of pavement for different kinds of streets and in the drafting of specifications.

With the city engineering department the work of the Civic League, although at first looked upon with some misgiving, has been accepted in the spirit of hearty coöperation and good will. The chief engineer has stated that he welcomed the services of the league and that he would much rather have just criticism with public interest than have the work carried on without criticism and without interest on the part of the public.

Contractors Are Members of Pavers' Exchange

As regards the contractors, the work of the Civic League has met with little opposition, and the spirit of coöperation has made itself felt.

The principal paving contractors of the city a year ago formed an association known as the Pavers' Exchange, the avowed purpose of which is for mutual service and the promotion of better work. No firm or individual is eligible for membership in this exchange until he has been engaged in the paving business in the city for at least six months. The exchange has the power to reprimand, fine, suspend or expel a member for conduct which, in the opinion of its members, is improper or in prejudice to the welfare and reputation of the exchange.

Meetings of the exchange are said to approximate an engineering-society meeting. Ways and means of doing work are discussed, the performances of various machines described, and other matters of professional interest taken up. The president of the exchange, on occasion, employs a paving engineer to inspect and report upon the work of the various members; and if the work is not up to the standard of the exchange, the guilty contractor is liable to criticism and reprimand at a meeting of the members.

Exchange Makes Suggestions to City

The exchange makes recommendations to the city engineering department in regard to methods of work. For instance, in 1917 a granulated slag cushion was recommended for all stone-block paving, a suggestion which was subsequently adopted. Other similar recommendations are made every year. One in 1917 was for the enforcement of all ordinances applying to the use of heavy trucks on pavements.

The activities of the exchange extend to such cooperative work as the pooling of materials, so that a contractor with a surplus of cement or other construction material will supply at cost one who is short. There is also a laborers' exchange agreement whereby one contractor may have an opportunity to utilize the services at once of any laborers whom another contractor is letting go. Some attempt has been made on the part of a few members of the exchange in the line of coöperative buying of broken stone and gravel.

While such an association offers an opportunity for collusion and exorbitant prices, the members of the exchange deny any such object; and no evidence has been produced to show that this has been done. The advantages of coöperation among the contractors are admitted by all the engineers connected with the work and have been practically proved in this instance, at least so far as the contractors are concerned.

Apparently little public opposition is being met because of high prices. A large part of the new paving work is by the assessment method, by which the city pays but one-tenth of the cost. Requests for pavements by property owners continue to be made, and but seldom is an objection raised because of the present high prices. The accompanying table, compiled by the secretary of the Pavers' Exchange, shows the range of prices of paving materials and labor in Cleveland from 1914 to Mar. 1, and July 16, 1917, quotations. Mar. 1 is about the date of several of the new paving contracts.

The prices bid for various types of pavements have run about 25% above the engineers' estimates of from one to three years ago, but this has not interrupted the work. The people of Cleveland want pavements and want them now. The prices the city is paying follow:

RANGE OF PRICES OF MATERIALS (F. O. B.) AND LABOR USED IN PAVING CLEVELAND STREETS, 1914 TO 1917

	1914	1915	1916	Mar. 1, 1917	Increase from 1914	July 16, 1917	Increase from 1914
City test cement, per bbl	$1 35 90 95	$1 65	$1 90	$2 32	41%	$2 80	51%
Crushed stone, per ton	1 00 1 05	1 08	1 13	1 33	32%	1 33	32%
Conglomerate, per ton	65 70	75	88	90	27%	1 20	45%
Bank sand, per ton	55	65	70	75	26%	1 15	52%
Dressed block, Medina per sq.yd	1 42	1 55	1 65	1 65	13%	1 65	13%
Common brick, per thousand	6 75	7 00	7 50	11 00	38%	15 50	56%
Paving brick, 4 in., per thousand	16 50	16 75	19 50	21 50	23%	24 50	32%
Paving brick, 5 in., per thousand						29 00	
Teams, per hour	50	50	75	80	37½%	80	37½%
Labor, per hour	17½	22½	40	45	61%	45	61%
Freight increase, per ton	1 50			1 61	6%	1 61	6%

For 5-in. brick on a 6-in. concrete base, about $3.33 per sq.yd.; 4-in. brick on a 6-in. foundation, $2.88; bitulithic, $1.42; sheet-asphalt, $1.58; asphaltic-concrete, $1.37; with Mexican asphalts in place of Trinidad the prices are $1.46 and $1.30 respectively; 4-in. creosoted wood block on mortar cushion, $3.23; two-course concrete, from $1.98 to $2.40 per sq.yd.

The choice as between monolithic and sand-cement bedding for brick-pavement construction has depended chiefly on the willingness of contractors to undertake monolithic work; however, the tendency is more and more toward this type, the contractors who have had experience preferring the monolithic method.

The prices given for bituminous pavements and the wood block do not include concrete foundations. The various types of bituminous pavements are used largely for resurfacing older pavements. Foundation concrete (1:3:6) with unwashed gravel aggregate is costing about $6.50 per cu.yd., or $1.08 per sq.yd. for a 6-in. base and $1.44 for an 8-in. base.

Preparation of a Street Code Recommended By Civic Bodies

One of the most important developments is the interest aroused in securing street regulations which will preserve the new pavements as long as possible. Several meetings have been held by representatives of the Civic League, the Engineering Society and the Electrical League, for the purpose of discussing a street code which will provide for proper organization of all street work, including the placing of all substructures, the preparation of permanent plans and records and an effective coordination of all street functions. The great weakness of having a repair department distinct from the engi-

neering department has been emphasized, and an attempt is being made to draw up ordinances which will cover all the defects in the present system. While recognizing the difficulty in drafting a code comprehensive enough to accomplish this purpose, the paving committee of the Civic League has attacked the problem with enthusiasm and earnestness, and a report is expected late in the fall. If such a code can be framed, it will be the first in the country; and its enforcement may be expected to be a great step in eliminating one of the trials of city and paving engineers.

The need for adequate cost records is another matter which the conference has taken up, so that sufficient data may be collected from it to determine with some accuracy the width of pavement, thickness of base, type of pavement and apportionment of cost between city and property owners. Also, some effort is being directed toward improving the appearance of street fixtures by regulating their use and location and avoiding wherever possible the duplication of fixtures. In fact, the whole subject of street improvement is under discussion by a board of open-minded, public-spirited engineer citizens.

Wisconsin Enacts Three Notable City-Planning Laws

Zoning by City-Plan Commissions Made Possible—Street-Widening Procedure Authorized—Building-Setback Control

By S. J. Williams
Building Inspector, State Industrial Commission, Madison, Wis.

THE Wisconsin legislature, whose session has just ended, passed three notable city-planning laws. The most important of these authorizes cities to regulate and restrict the location of trades and industries and the location of buildings for specified uses and to establish districts within which certain industries or other occupancies may be excluded or subjected to special regulations. The city may also establish districts within which the height and area of buildings may be subjected to special restrictions. In other words, the new Wisconsin law is modeled after the present New York law. A zoning ordinance must first be framed by a city-plan commission, if the city has one.

Powers of City-Plan Commissions

Under a law passed four years ago, cities are authorized to provide city-plan commissions consisting of the mayor, the city engineer, one alderman, the president of the park board, if there is such a board, and three or four citizen members appointed by the mayor and serving without compensation. This commission has no legislative powers, but the council must refer to it, before taking any action, all questions relating to streets, boulevards, parks, public buildings, etc. To these duties are now added the formulation of a districting plan, as already mentioned.

When the report of the city-plan commission has been presented to the council, the council may alter it, but only after public hearing. The plan must then be finally adopted by the council. If a change is proposed in a district once established and if 20% of the proposed owners of the frontage involved, or the frontage opposite or behind that in question, object, then such amendment requires a three-fourths vote of the council.

The new zoning law, which applies only to new buildings and extensions of existing buildings, supersedes a former law which authorized cities to establish residence districts, but provided for damage suits by property owners, which provision practically nullified the law. Milwaukee tried to establish residence districts under the old law, but the ordinances were repealed when damage suits were brought. The old law was also defective in other ways. The new law was actively supported by the Milwaukee City Council. The Public Land Commission (which in Milwaukee exercises the functions of a city-plan commission) plans to take early steps toward the formulation of districting ordinances.

In Madison, the state capital, an ordinance is before the council providing for a city-plan commission, which is expected shortly to be passed, after which the commission will undoubtedly take up zoning as one of its first duties. Madison, on account of its location on a narrow neck of land between two lakes and also perhaps on account of the largely transient character of its population, has developed problems of congestion which would ordinarily be found only in a much larger city.

Street-Widening Procedure

A second important new law is one on the widening of streets. This provides that, if the council decides to widen a street, a jury shall be convened to take action thereon, as in other condemnation proceedings; but after such action, if buildings are located on a part or all of the land to be taken, then the city may, at its discretion, take over such land at once, paying the necessary damages; or may wait until the building is torn down and then take over the land without paying for the building. Thus by waiting 10 or 15 years the city may gradually take over one portion of land after another as the old buildings are torn down to make way for new ones, and the public treasury is saved the expense of paying for the old buildings.

As soon as the jury's verdict is entered confirming the necessity for widening the street, it immediately becomes unlawful for any person to build upon the land to be thus taken, or to increase the height of any existing building on such land; and if any one does so build, he must remove his building without cost to the city when the latter is ready to buy the land.

City Councils May Establish Building Lines

The third statute provides that a city council may establish building lines set back from the street line and may prohibit building between such lines, provided that any person injured by such action may recover damages by proceedings begun within three months after the adoption of the ordinance. This makes it possible to establish such building lines where the property owners agree not to sue for damages or where, if one or two owners are actually damaged and insist upon reimbursement, the other property owners are willing to stand the expense for the sake of the improvement to their property. It is not expected that the city would ordinarily be willing to pay such damages.

Retaining Dams Prevent Overflow of Sewers at Binghamton

Sidehill Streams Which Used To Fill with Debris and Cause Floods Now Controlled by Dams and Paved Channels

By W. Earl Weller
City Engineer, Binghamton, N. Y.

TROUBLESOME flood conditions due to the clogging of the entrances of storm-water sewers at Binghamton, N. Y., were cured last year by the construction of several small retaining dams that slowed up the flood flow and stopped the débris. The solution might be applicable to other communities and is for that reason outlined here.

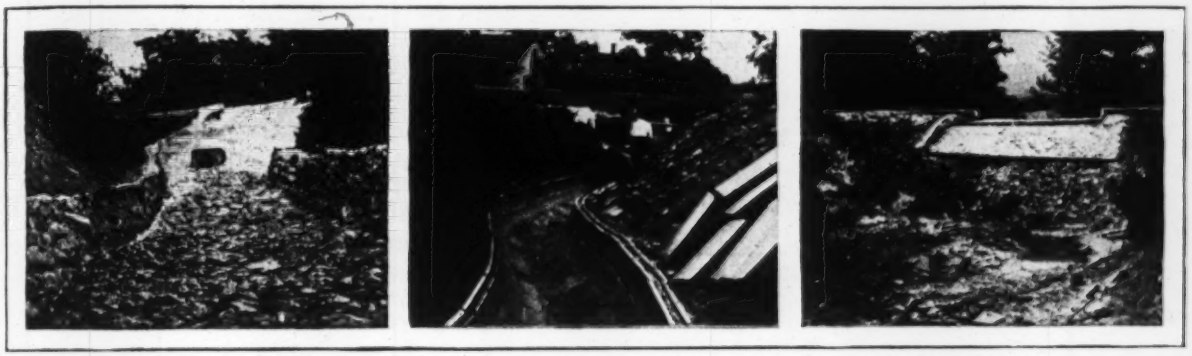
Binghamton is situated at the junction of the Chenango and the Susquehanna Rivers, all of the business district and a large part of the residential section being on a flat alluvial plain having a general elevation of 845 ft. above sea level. Hills rise abruptly from the edge of this plain to heights ranging from 1250 to 1600 ft. above sea level. Seven small creeks (dry for eight months in the year) carry the run-off from the hills across the flat land and into the rivers. On the hillsides these creeks are constantly cutting new or enlarging old channels through the clay and gravel. This material is brought down to the lower reaches of the streams, where it fills the channels, causing the creeks to overflow their banks. The steep profiles of the creeks and the nature of their drainage area promote freshets, every rainstorm at all heavier than normal converting the dry channels into rushing torrents.

Stopped Sewers Would Cause Floods

One of these creeks, the smallest, was especially troublesome. It is formed by the junction of two small creeks on a hillside about a mile south of the Susquehanna River and flows north into that river. The lower half-mile of the stream had been converted into a 42-in. storm sewer, and the starting point of trouble was at the entrance to this sewer. Whenever the little stream went on a rampage, it would pile brush, silt, gravel and fairly large stones (6 to 10 in. diameter) against the grating at the entrance to the sewer. The waters would then continue their trip to the river by way of streets; backyards and cellars. The 42-in. pipe, which has a very steep grade, is amply large to care for all the water the stream can deliver.

It was decided to try the effect of retaining dams to discourage the gravel-carrying proclivities of the creek. The 42-in. sewer was extended about 500 ft. south to and beyond the junction of the two branches. Two small dams were constructed on the larger branch and one on the smaller branch. The pools formed by these dams have an aggregate capacity of from 18,000 to 20,000 cu.ft. Each dam is pierced with a a 20-in. pipe and equipped with a spillway. The work was very inexpensive and the result so successful that the plan deserves consideration in other cities that may be troubled by similar conditions.

The sewer extension was built of segment block. In order to economize on the excavation and to avoid land damage, the sewer followed very closely the bed of the stream. This necessitated some short-radius curves that taxed the flexibility of the construction to the utmost. By chipping some of the blocks one radius as short as 20 ft. was successfully negotiated. The ends of the sewer were protected by vertical screens composed of ¼ x 1-in. flat bars spaced 1 in. center to center.



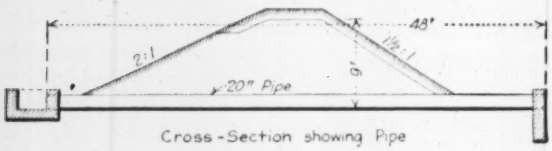
FRONT OF DAM (LEFT), INVERT OF NEW TILE BLOCK SEWER (CENTER), AND REAR OF DAM AFTER FLOOD (RIGHT)

Approach Channels Paved

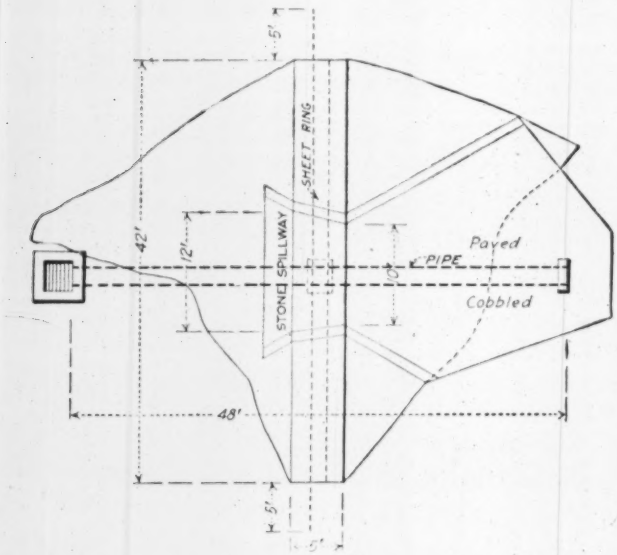
Above these entrances to the sewer the bed of the creek was excavated to a uniform grade and paved with stones taken from the bed of the stream and grouted into place. This pavement was placed fairly smooth and flat for a distance of 15 ft. above the entrance. Considerable finer material finds its way through the gratings at the dams and collects at these points, from which it is readily removed by shoveling. The remainder of the paving was laid very rough in order to reduce as much as possible the velocity of the approaching water.

The three dams are all of similar construction differing merely in size. They are of earth construction with a concrete and corrugated steel sheet-piling core wall. The sheet-piling was driven well into the banks and well below the bed of the stream and 18 in. of concrete placed against its downstream face. The upstream faces of the dams are on a 2 on 1 slope and the downstream face on a 1½ on 1 slope. All earth was placed in 12-in. layers and tamped. The dams have a top width of 5 ft. at the spillway, which is depressed

1 ft. below the top of the dam. The downstream face, the spillway and the upper 6 ft. of the upstream face are paved. A line of 20-in. cast-iron pipe runs from a concrete sump about 15 ft. from the upstream toe of the dam to a headwall flush with and at the elevation of the downstream toe. The sump is fitted with a horizontal bar screen. No valves are provided on this 20-in. line, so that it may be constantly open to care for the ordinary flow of the stream.



Cross-Section showing Pipe



FLOOD-CONTROL DAM DETAILS

Since completion, these regulating works have been subjected to three very heavy storms, one of which approached the magnitude of a cloudburst. In each instance the water flowing in the creek exceeded the capacity of the 20-in. pipe and the pools behind the dams gradually filled to the level of and overflowed the spillways. As the storm passed, the 20-in. pipes drained the retained water from the pools and at no time was the capacity of the 42-in. sewer reached. All stones and débris carried by the streams were held back by the dams and were easily and cheaply removed.

One defect in the detailed design disclosed itself. The horizontal screens on the sump wells were too easily clogged either by natural causes or by boys intent on transforming the dry pools into swimming holes. This is being corrected at present by replacing the horizontal screens with screens built in the form of a box 3 ft. square in plan and from 3 to 5 ft. in height. This is the only change that will be made in the original plans if other regulating dams are constructed in Binghamton. The size of the pipes through the dams was criticized as being too large. Experience has proven that the 20-in. pipes are not too large. Any lull in the rainfall gives the pools a chance to unload part of their contents and to prepare for another downpour. The cost of maintenance has been very small.

The total cost of the work was $6862. The dams complete with pipe lines cost $875.33 each, and paving the creek bed cost $498.75 (about $3 per lin.ft.). The 42-in. sewer cost $5.15 per lin.ft. The cost of placing the segment block was three times the figure usually assumed in estimating such work, owing principally to the sharp curves in the line.

The general plan was worked out by Commissioner of Public Works John A. Giles in 1915. Detailed plans were prepared by the Bureau of Engineering, and the work was constructed under the direction of that bureau during the summer of 1916. F. A. Tillman was the engineer in charge of design and construction.

Chloramine at Denver Solves Aftergrowth Problem

Bacterial Increases in Chlorinated Filtered Water Eliminated Entirely at Greatly Reduced Cost for Chemicals

STERILIZATION by the use of chloramine is now an established fact on this side of the Canadian line. Following the publication of the results at Ottawa by Joseph Race (*Engineering News-Record*, June 21, page 606), H. I. DeBerard, chemist for the Denver Union Water Co., began immediately to try out chloramine. Aftergrowth counts on gelatine in the Capitol Hill reservoir dropped within four days after its use was initiated from 15,000 to 10 per c.c. The hypochlorite dose was also cut from 0.26 to 0.13 p.p.m. available chlorine. There was added 0.065 p.p.m. of anhydrous ammonia. These amounts were found to be the minima that could be used on the filtered effluent from a stored lake water.

At another point an unfiltered lake water had been treated with 2 lb. per million gallons of liquid chlorine. After application of chlorine, the gelatine count was 20 per c.c., but multiplication took place during the passage through a 48-in. conduit for 10 miles and the numbers would increase to 200. As this water enters directly into the city mains no opportunity was afforded to note any further increase. The liquid-chlorine outfit has been abandoned at this point and the former hypochlorite plant put back into commission. Effectual sterilization without subsequent aftergrowths, either at the end of the conduit or in the city distribution system, is obtained by the use of 0.2 p.p.m. of available chlorine and 0.1 p.p.m. of anhydrous ammonia.

Until permanent plants are installed a 10% solution of ammonia will be used. Ultimately about a 1% solution of ammonia, equivalent to 0.29% anhydrous ammonia, will be provided for. A more accurate feed can then be obtained and possibly the amounts may be still further reduced.

In using this mixture it has been found absolutely necessary to test each mix of bleach for available chlorine and then correct the amount of solution added to secure the required amount of available chlorine. The experiments were carried out and the new equipment installed under the direction of D. G. Thomas, chief engineer of the Denver Union Water Company.

Rational Study of Rainfall Data Makes Possible Better Estimates of Water Yield

Second Phase of Preventing Failure of Hydraulic Projects from Lack of Water Embraces Weighting and Interpolation of Records

By ROBERT E. HORTON
Consulting Hydraulic Engineer, Albany, N. Y.

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Our need of more dependable estimates of probable water-supply for power, domestic-consumption and irrigation projects was outlined in Engineering News-Record *of June 7, p. 490, together with some suggestions for more adequate studies of stream yield, frequency of light flows, degree of flashiness and dry-weather evaporation from storage. In the following article, the author turns to a second phase of the broader problem to suggest similarly what improvements over common practice are advisable in the use of rainfall data.—Editor.*

A GOOD example of certain prevailing methods in hydrologic estimates that seem worthy only of condemnation is seen in the determination of the average precipitation over a drainage basin, year by year. The practice is not uncommon of assigning weights to different rainfall records within and without the drainage basins, basing these weights wholly on judgment. Here is a clear case where assumptions should be eliminated and the results made to rest directly on physical data.

It has seemed to the writer desirable to devise a method, first, that would provide a definite rule as to which records should be included and which excluded in estimating the mean precipitation on a drainage basin; and second, that would always give the same mean precipitation from the same data, thus eliminating the personal equation and element of judgment as largely as possible.

Geometrical Assigning of Weights

Other things being equal, the weight assigned to a given rainfall record in determining the mean precipitation on a drainage area in a given year should be proportional to the percentage of the total area of the drainage basin to which this given station lies nearer than does any other rainfall station. This purely geometric method of assigning weights to rainfall records was suggested by A. H. Thiessen in the *Monthly Weather Review*, July, 1911, pp. 1082-4. It was independently developed and has been extensively used by the writer.

In the application of the method a small-scale outline of the watershed boundary should be drawn and the different rainfall stations within and adjacent to the area located on the same map.

Fig. 1 illustrates such an outline map for a small basin having one station lying within the area and several stations adjacent, but external to it. Lines connecting the different stations are drawn, as 1-2, 2-3, and perpendiculars are erected at the median points on these lines, as *AB* and *BC*. Station 1 lies nearer than any other station to all points within the inclosed area *ABEFG*. Station 2 lies nearest to the portion of the figure *GABC* and station 3 nearest to the portion

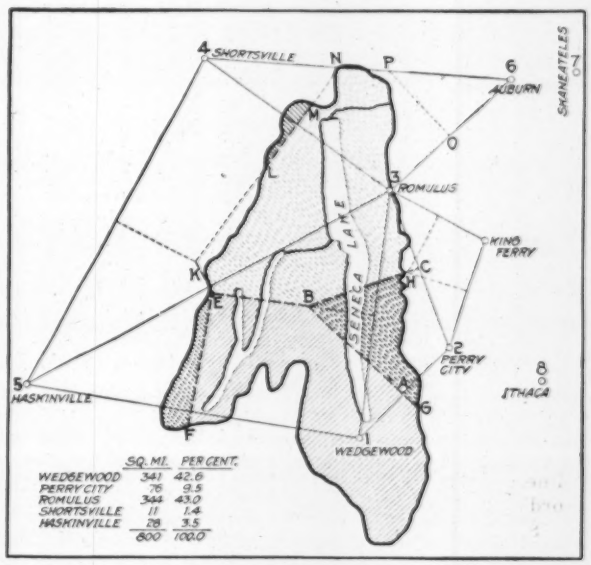


FIG. 1. WEIGHT ASSIGNED GIVEN RAINFALL RECORD IS PROPORTIONAL TO AREA NEAREST OBSERVATION STATION

of the figure *BHKLMN*. Points on the line *GB* are equidistant from stations 1 and 2. Stations 6, 7 and 8 are not applicable to any portion of the area and may be eliminated. This is evident in case of station 6, since the perpendicular *OP* at the median point of the line 3-6 lies wholly outside the area. Hence no part of the area is as near to station 6 as to station 3. The graphical construction is easily checked by the fact that the perpendiculars at the median points of the three sides of a triangle intersect in a common point, as *K* in the case of the triangle 3-4-5. The areas of the figures nearest the different stations may be determined by planimeter and the corresponding percentages of the total area computed. The precipitation at station 1 for each time unit is multiplied by the corresponding percentage and so on for each of the other stations and their appropriate areas. The sum of the resulting weighted or percentage quantities is used as

the mean precipitation on the area for the given time unit.

Cases will arise where, owing to abrupt changes in elevation and corresponding changes in precipitation, the subdivision lines between areas belonging to each rainfall station as determined by this method will need some modification. In general, rain gages are located in the valleys, although cases may arise where they are all at the higher elevations in a given basin. These facts should be considered in interpreting precipitation records, but it should be borne in mind that precipitation does not always increase with altitude. In general, such an increase occurs only where moisture-bearing winds are deflected upward by a slope.

Theoretically, the increase in precipitation from an ascending air current is a function of the inclination and not of the absolute altitude. A clear understanding of the relation of coast lines, prevailing winds and topography to precipitation will often help toward a correct determination of the rainfall on a drainage basin, but arbitrary modifications of actual records should always be avoided, except as dictated by adequate scientific reasons applicable to the specific case in hand.

Interpolation of Missing Rainfalls

It frequently happens that the data for some months are missing in rainfall records used as a basis for estimating the precipitation on a drainage area. Various methods have hitherto been used for filling in gaps in rainfall records, but no uniform practice seems to have been established. Comparisons with observed rainfall show that most methods of interpolation of monthly precipitation may be subject to large errors in individual cases. The use of the mean of the precipitations at three surrounding stations in place of the missing record has the advantage that it is simple and is based on contemporaneous data. That method, however, gives equal weight to the records at each of the three stations used, although they may be at very unequal distances from the interpolation station.

In the absence of information to the contrary, the best assumption which can be made is that the rainfall varies uniformly between adjacent stations. Using this principle, the writer devised the following method of interpolating rainfall, which depends upon the fact that the position of a plane is completely determined by the coördinates of three points in the plane.

Inclined Plane Method of Interpolation

Select three base stations surrounding the interpolation station. On a suitable map (Fig. 2), showing the relative positions of the stations, connect any pair of the base stations, erect perpendiculars to this line at the stations, and measure off on each perpendicular a length proportional to the precipitation at that station for the period to be interpolated. On the assumption of uniform variation, the precipitation at any point along this line will be proportional to the ordinate from the base line to the line connecting the two plotted points.

Draw another line from the third base station *C*, Fig. 2, through the interpolation station *D*, intersecting the base line *AB* at *E*. Erect a perpendicular to *AB* at *E*, intersecting the line *FG* at *H*. The precipitation at *E* is assumed to be proportional to *EH*. Draw perpendiculars to *CE*, one at *C* proportional to the precipitation at that station, and one at *B* equal to *FH*.

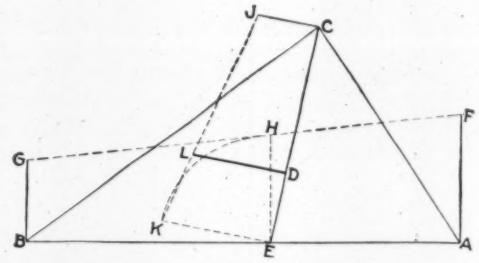


FIG. 2. RAINFALL AT A GIVEN POINT IS INTERPOLATED FROM THREE NEAR-BY STATIONS

Connect these lines by a line *JK*. Then a perpendicular *DL* at the interpolation station *D* will have a length proportional to the precipitation at *D*.

The graphical construction is extremely simple. Only simultaneous records are used, and the method involves but little more labor than the use of the mean of the three surrounding stations, but it is more logical. The weight given to remote stations in the inclined-plane method decreases as the distance increases.

Modification of Method

In practice, it will often be found that the rainfall does not vary uniformly between adjacent stations. In order to take this factor into account, the method may be modified as follows: Assuming that there is given for the interpolation station and for each of the three base stations the rainfall during the months preceding and following the month to be interpolated, find the ratio of the mean of these two months to the precipitation for the given month at each of the three base stations. Plot the values of this ratio by the inclined-plane method and find the corresponding ratio for the interpolation station. Multiply the mean of the rainfall during the preceding and following months at the interpolation station by this ratio. If preferred, the mean precipitation in the preceding and following years may be used with this method.

The modified inclined-plane method above described involves the principle that the departure, or abnormality, as it may be called, of the rainfall at the interpolation station in a given month as compared with the mean of the preceding and following months will be of the same nature as at the interpolation stations.

Rainfall Distribution

Hitherto in computing run-off from rainfall and other data, the month has been used as a time unit. Thus, details of distribution and precipitation are wholly ignored, yet these details are of the utmost importance. Considering the monthly precipitation only, the estimated yield of the stream would be the same whether the rain during a certain month having 2 in. precipitation all fell in a single storm or was distributed in 10 storms averaging 0.2 in. each. In the former case, only a small proportion of the precipitation would be lost by interception; and after the soil had dried out.

following the rain, the evaporation opportunity would be nearly zero. In the case of 10 storms of 0.2 in. each, 50% or more of the rain may be lost by direct interception and the soil surface evaporation opportunity would probably be 50% or more. Rainfall distribution thus affects the interception loss and soil evaporation losses directly. Its effect on the transpiration loss is taken into account if a method of estimating such loss from crop yields is used, as will be shown subsequently.

It is not surprising that monthly run-off estimates based on rainfall have often been criticized when so important a factor as rainfall distribution has been wholly neglected.

The natural time unit for estimating run-off is the storm period—that is, the average interval between rain storms in a given year and season. If the number of storms per month is used as a factor in estimating interception and soil evaporation losses, the monthly precipitation may still be utilized, thus avoiding the excessive labor of compiling precipitation data for shorter time units.

A third article will conclude this presentation of means for preventing excessive estimates of water-supply—discussing the conducting of a drainage-basin inspection, the effect of crops on run-off, evaporation losses, winter run-off and ground water storage.—Editor.

Temporary Hinges Advantageous in Concrete-Arch Erection

Guard Against Additional Stresses Arising from Arch Shortening Produced by Dead-Load Compression

By D. B. Steinman

Associate Engineer, Waddell & Son, Consulting Engineers, New York City

THE common assumption that, with an arch curve laid out to conform to the dead-load equilibrium curve the dead-load produces no bending moments in the arch, is materially in error. This error arises from the arch shortening produced by the dead-load compressive stresses and is similar to a fall in temperature; it results in a reduction of the horizontal thrust, with a consequent divergence of the true pressure line from the assumed arch axis. The pressure line becomes more stilted, passing above the axis at the crown and below the axis at the springing, thereby increasing the compression in the outer fibers at the crown and in the inner fibers at the springing.

The magnitude of the foregoing error depends upon the proportions of the arch. It may be neglected in arches having a rise greater than one-fourth of the span; but in flatter arches it becomes increasingly serious. From some designs that have been worked out, in which the depth of rib was uniformly 3% of the span length, it appears that the addition to the dead-load stresses on account of rib-shortening may attain considerable magnitude, especially in the flatter arches.

A method of avoiding these additional stresses is to provide hinges at the crown and springing during the erection of the arch. Temporary hinges were employed by the late George S. Morison in the construction of masonry arches; they have also been used in a number of European bridges. These hinges should be closed (by pouring concrete into the joints) only after the full dead-load is on the structure and the shortening and shrinkage changes have taken place. This device of temporary hinges is particularly advantageous in flat arches; it practically eliminates all dead-load bending stresses in the structure in addition to stresses from shrinkage or settlement. Furthermore, by selecting the temperature for closing the hinges, the range and effect of the subsequent variation may be minimized.

The above advantages of the three-hinged construction apply mainly to the conditions during erection. For the finished structure, a hingeless type is to be preferred on account of the greater rigidity and the greater security against crown settlement. Temporary hinges eliminate the shrinkage stresses without involving the difficulty in the construction of bulkheads caused by interference with the steel in the case of reinforced construction.

In laying out the arch curve for the first trial, the writer has found that a simple circular curve is ordinarily satisfactory. With this curve drawn, the weights of the arch segments and superimposed filling are figured and the resulting equilibrium curve constructed. With this pressure line as a new arch curve, the dead-loads may be revised and a second equilibrium curve drawn; as a rule, however, the first curve may be retained without the revision of a second trial.

For ordinary concrete arches, with earth-filling up to a level line, the ideal arch curve will be found slightly higher at the haunches than a simple circular curve. The following table gives the amount of this deviation, as found from actual designs, for different rise-ratios:

Ratio of Rise to Span	Deviation from Circular Curve at Haunches, in Per Cent. of Rise
0.25	4.3
0.20	4.2
0.15	3.7
0.10	3.5
0.07	3.1

In the flatter arches, the deviation from a circular curve is barely noticeable.

Theoretically, the ideal arch curve is the equilibrium curve for the dead-load plus one-half of the live-load covering the full span. This curve would be the exact mean of the two extreme curves obtainable by placing the live-load alternately on the two halves of the span. In practice, however, on account of the usual small ratio of live- to dead-load, there is no material difference in using the equilibrium curve for dead-load alone.

American Society Guarantees German Hospitality for Engineer Troops

The *Bulletin* of the General Contractors' Association notes in the *Proceedings* of the American Society of Civil Engineers for May that among the societies to which members of the American society will be welcome is the Architekten-Verein zu Berlin, Wilhemstraase 92, Berlin, Germany. The *Bulletin* continues, "Colonel McKinstry's regiment please take notice and go there, stopping on your way to partake of the welcome extended by the Sachsischer Ingenieur und Architekten-Verein in Dresden."

New York Road Building Suffers from Sins of Past

Incompetent Contractors Threw Up Work Which State Must Finish at Present High Prices

ROAD BUILDING today in New York State is more affected by previous methods of letting contracts than by war conditions, and though construction is far from normal there is a great deal of work under way. This work is practically all the completion of contracts canceled by the state because of the inefficiency displayed by the contractors.

The situation grew out of the enormous amount of road work to be accomplished last year within a short space of time, a condition which gave opportunity to numerous so-called contractors who had had no experience in road building and oftentimes not even in contract work. Throughout the state a number of such contractors have involved the state in serious delays and legal difficulties without having done any work to speak of. The result is that the state has almost as much uncompleted work at the present time as ever before, and the Highway Department is not attempting to let any new contracts. There are about 1500 miles under construction. The finishing of these canceled contracts is being done by the state either by day labor, under the supervision of high-class construction superintendents, or by a new contract.

Many difficulties are involved in this taking over of work, as the cost always amounts to more than the price bid a year or more ago; and in every case the state will be compelled to sue the surety company for the difference. It is naturally difficult to get contractors on such work. There is a very real shortage of labor and the wages are high—from $2.50 to $3 per day of eight hours. Hardly a single contractor is working with a normal force. On 165 state jobs in progress the first part of July the average number of men to a job was 27, whereas 35 would have been the number under more normal circumstances.

Main Routes To Be Completed Early

The chief aim now in construction work is to complete all contracts which are essentially important connections to main routes and also to complete those roads next of importance which tie together the feeder system of roads. The idea in this is that should the transportation of supplies reach a greater magnitude than could be accommodated by the railroads, the roads would be in condition for a heavy motor-truck traffic.

There will be lettings from time to time of contracts that have been canceled and also for repair work. The new construction work and that to be done by the repair department, which will be in the neighborhood of $5,000,000, will, if the contractors are able to do it at all, constitute about a usual year's work. Should conditions be more favorable later, the authorities seem willing to go on with the letting of more construction work.

City work in Albany, Syracuse, Rochester and Buffalo is proceeding in an almost normal manner, and is limited only by the ability of contractors to take care of it. There is no tendency on the part of city officials to hedge on public improvements, and in all these cities probably as much public work, certainly as much pavement work, is under contract as the contractors can take care of.

In the west of the state the labor situation is most acute. In Rochester there was recently a three months' strike on nearly all construction work which practically tied up everything for that period of time. This was settled by granting a rate of 32c. an hour, which was considerably less than the laborers' demand.

Labor Scarcity Is Hurting Municipal Contractor

Municipal contractors are almost wholly at the mercy of what few laborers are available, and seem everywhere alive to the opportunity to substitute mechanical equipment. An instance which might be mentioned is in Buffalo, where a contractor for making pavement repairs met with the demand on the part of the laborers, who are employed to cut out the old asphalt with axes, for an increase in wages of 30 to 50%. He met this demand by devising a mechanical pavement cutter driven by a gasoline engine which, while it is not as economical or as efficient as might be hoped for, has the great advantage of being a safety valve on the demands of his men. He has found it well worth while to operate these machines, so that the laborers might see that there was a limit to what they could demand, and that there was a very likely chance of their work being replaced by mechanical means.

Near Cortland a gang of 30 convicts from Auburn prison is engaged in doing some heavy grading work on a feeder line to a state highway. This work is in charge of an experienced road foreman, but the convicts are in charge of and supervised by two regular guards from the prison. The convict camp consists of an old farmhouse fitted up with iron cots and a temporary wooden building used for kitchen and mess hall.

Convict Laborers Are Paid and Work Practically Unguarded

The convicts chosen for this work were picked from the whole number of inmates at Auburn and none go who do not so elect. They are much better fed than when in prison, have four packages of tobacco given them a week and are allowed pay of 50c. a day. No arms or prison equipment are in evidence, and the men are at perfect freedom to move about as they choose, being practically on their honor to keep within prescribed bounds. There have been no escapes, and the only way discipline is enforced is to threaten, or finally to send, the prisoners back and get new ones to take their places.

This same crew, or a similar one, was used for heavy grading work on another piece of work in this vicinity. The men are used for grading work, laying Telford foundation, etc., but not for any road work requiring skill or experience. There are similar gangs at work in other parts of the state, but it appears that the use of convict labor as a whole is largely of an experimental nature and is not carried out on such a scale as to have any real effect on the labor situation; although highway officials believe that were laws passed which would give the highway department more jurisdiction over their work convicts could be used in much larger numbers to advantage.

Fire and Load Tests of Columns Now Being Made

New Testing Machine at Underwriters' Laboratories Tests Building Columns Under Combined Fire and Load Conditions

ABOUT two years ago the National Board of Fire Underwriters, the Associated Factory Mutual Life Insurance Companies and the Bureau of Standards, acting jointly, prepared plans for a program of testing large building columns under load, at the same time subjecting them to the usual fire tests, with the view of determining the effectiveness of different types of fireproof columns now in use or proposed. The testing machine has now been installed in the Underwriters' Laboratories in Chicago, and the tests are under way.

The collection of columns on which tests have been begun includes samples of various types. Among these are rolled-steel sections, built-up steel sections, steel pipe filled with concrete and vertically reinforced and hooped columns. It is proposed also to test several wooden columns. At least one of each of the sections is to be tested without protection; others are to be partly protected with concrete, and still others will be completely protected with various thicknesses of concrete, clay tile, gypsum blocks and plaster on metal lath, in accordance with the methods commonly employed in building practice.

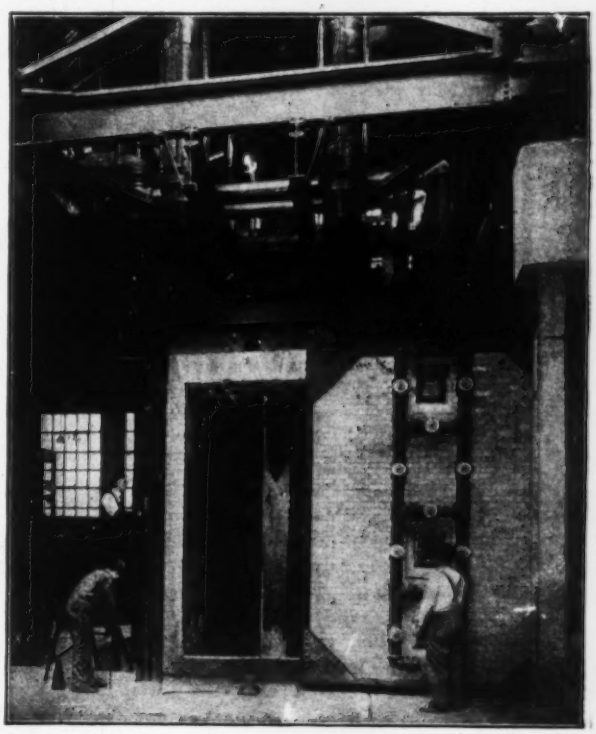
Test Equipment Is of Special Design

The test apparatus is located in a fireproof building designed especially for work of this character. The central portion of the building is one story high, with headroom of approximately 37 ft. At three sides of this portion the building is two stories, with headroom of 17½ ft. under the second floor. The central portion of the building is provided with sliding skylights that can be opened for ventilation and with a traveling crane.

Exclusive of two shallow pits at the bottom to receive falling material and carry off the water during the fire-stream tests, the test furnace has a height of 12 ft. In horizontal cross-section it is a 7-ft. square. Stationary brick walls form two of the opposite sides, while two movable brick walls in steel frames or panels suspended from overhead beams by trolleys provide the other two sides of the inclosure. The top of the furnace is of heavy fireclay blocks supported by a steel frame; it is partly removable to permit the installation of the columns to be tested. The bottom is formed by the fireproofing on the steel bearing plate and restraining frame of the loading apparatus. Four 13-in. flues, extending from the top of the furnace out through the roof of the building, carry away products of combustion. The fixed sides of the furnace have mica glazed observation windows, so arranged that all parts of the column under test can be observed. Eight 6-in. blast burners of special design heat the furnace.

The apparatus employed in applying the loads to the columns during the fire and the fire-stream tests consists essentially of a hydro-pneumatic ram, the pumps and tanks supplying the pressure, the necessary restraining frames and the accessory pressure-indicating, controlling and recording apparatus.

The ram has a rated capacity of approximately 256 tons; it is bolted to the under side of the heavy steel beams which form the top of the restraining frame in such a manner that it will engage the top plate of the test column when that is in position. The column transfers the compression to the beams constituting the bottom of the frame, and these complete the action by transferring the stresses back to the top through steel tension cords which form the sides of the frame. The ram is designed to maintain the load on the test column



NEW TESTING MACHINE DETERMINES RESISTANCE OF COLUMNS TO COMBINED FIRE AND LOAD

automatically and to develop characteristic deformation at the point of failure.

The temperatures within the furnace are indicated by means of thermocouples inserted through the walls near the top, middle and bottom; temperatures at the surface of the structural portion of the test column are measured with thermocouples placed at several levels on the column.

Deformation and deflection of the column during test are taken by measuring the movements of protected wires attached one on each side of the column at both ends of a 37-in. gage length. One end of each wire is attached to the column, and the other is weighted and passed over an idler at a point outside of the furnace as far away as room conditions permit. Movement is measured at intermediate points on the wires, and true movements at points of attachment of the column are calculated from the established ratio of distances.

For exposing heated test columns to the action of fire streams a special 4-in. hydrant is employed. There is a hydrant location on each of the two sides of the furnace that have movable walls, the respective distances from the middle of the furnace being approximately 26

and 39 ft. A standard play pipe with a 1¼-in. nozzle and with a pressure gage tapped into its base will be used. The hydrants are connected with a 6-in. underground main supplied by a pressure tank and an electrically driven fire pump of 500 gal. capacity. The hose connections on the hydrants are provided with pressure gages and 2½-in. hose valves.

How Tests Are To Be Made

After being allowed to season for a period of about a year, the column to be tested is placed in the furnace and the top and bottom bearings are adjusted for even distribution of load. The connections for temperature and deformation measurements having been made, the furnace is closed and readings on all instruments taken. The safe load is then applied, and a second set of readings is made of deformation and deflection. The gas is then ignited, and gas and air are gradually turned on to establish the predetermined temperature rise in the furnace. It is proposed to make this uniform for all tests although the exact temperature figure has not as yet been announced by the Board.

Readings on gages for load, on column and furnace thermocouples for temperature and on deformation and deflection instruments are taken in regular sequence at five-minute intervals up to a point near failure, the load being maintained as nearly constant as possible during the test. Observations of the visible effects of the fire on the column and its protection are made at regular intervals during the procedure.

After failure, the furnace doors are opened and the column is allowed to cool. Photographs and notes are made as a record of the general condition of the column. The covering is removed and its constituent materials investigated for deterioration due to fire.

When the fire-stream test is to be applied to a hot column, it is probable that the nozzle pressure of the hose stream will be kept at 50 lb. per sq.in. and the application maintained for five minutes, the tip of the nozzle being located 20 ft. from the column. After suitable observation of the effects of the fire and the water, the furnace doors will be closed again and the fire-and-water treatment repeated in the same or other predetermined manner.

The Choice of Grasses To Protect Road Embankments from Erosion

By W. C. Buetow
Division Engineer, Wisconsin Highway Commission, La Force, Wis.

THE use of grasses to protect embankments and slopes, particularly on high-class roadwork, is so generally neglected that very little information has been published as to the kinds which are most suitable. Much damage that cannot be prevented even by the provision of proper drainage and keeping cattle from trampling the slopes can be taken care of by the planting of well-chosen grass, which should be properly cared for until a mat or blanket has formed.

Grasses do not form a mat or blanket very quickly, due to the variance of the climatic conditions. The action of frost is the most disturbing factor, and on account of the depth of its penetration the upper stratum of the bank is kept in a loosened state that is very susceptible to the spring rains. For this reason it can readily be seen that shallow-rooted grasses are of no practical value.

A Grass Having a Good System of Roots Should Be Selected

When selecting grasses to be planted on the slopes, it should be kept in mind that a grass with a good system of roots is to be used, as well as one able to withstand the hot rays of the sun. Grasses that will grow on a sunny bank probably will not take root and form a mat on the shaded slopes, in which case a different kind of grass is necessary.

The protection to the bank lies almost wholly in the ability of the roots to interweave so minutely as to form a system to reinforce the surface stratum. Hungarian brome grass, Canadian blue grass, fescue grasses and Western wheat grass are good to plant. In many cases sod is handy to get and, when properly cut and placed, offers very good protection. The sods must be held in place by wooden pegs until the grass has taken root.

Seeding and planting are equally successful when conducted properly. The surface in each case must be prepared in order to make it at all conducive to a good growth. The seed cannot be merely distributed on the slope and left with the hope that it will catch. If necessary, the ground should be manured before any seeding is done and if a sandy slope is treated, the surface must be protected from the wind with straw or brush until the grasses are able to withstand the elements.

Mixed Seed Best for Clay Soils

Different kinds of soil require a certain kind of grass or a combination of several kinds. For shaded places a combination of Kentucky blue grass, wood meadow grass, crested dog's tail and various leaved fescues are well adapted.

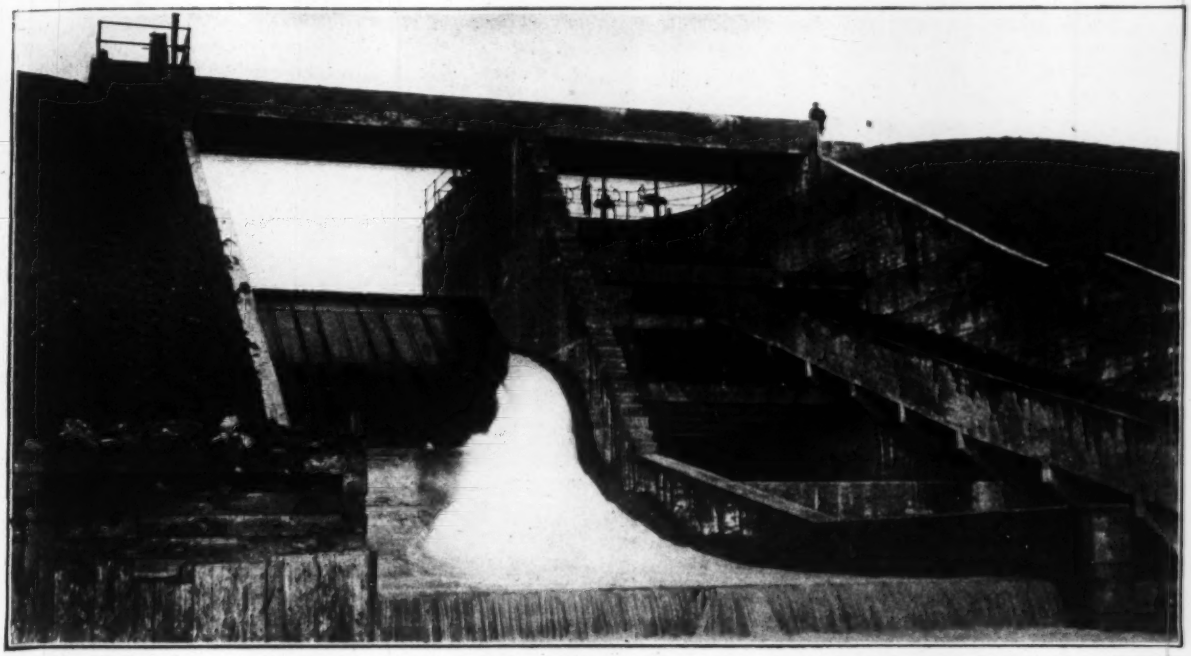
Clay soils can be treated with a mixture of Kentucky blue grass, English rye and fancy red top. The rye grass gives an early quick result, the red top makes a bottom grass, and the blue grass is the permanent feature.

Sandy soils require a quickly growing binding grass that will withstand the drought. Creeping bent, Rhode Island bent and fine-leaved fescue are grasses that answer this purpose. Western wheat grass has unusual ability to grow on the sunny side of an embankment. Creeping bent, Canada and Kentucky blue grass and crested dog's tail are quick growing, deep-rooting grasses that will bind the soil until such time as the more permanent grasses are in possession. Sweet clover and creeping honeysuckle are recommended for planting in cuts.

Denver Experimenting with Road Oil

Denver, with its high costs for water for dust prevention, has had to turn to oil as a more suitable palliative. The city officials have started experimenting with a 1000-gal. motor-driven oil spreader. Six carloads of 65% asphaltic oil are to be used.

Island Lake Storage Dam Has Immense Log Sluice



Bear-Trap Dam of 30-Foot Clear Width and a Crest Rise and Fall of 20 Feet Passes Logs—Alongside Is 28-Foot Sluiceway Closed by Vertical Arch with Sluice Gates

Prepared in Office of GARDNER S. WILLIAMS
Consulting Engineer, Ann Arbor and Chicago

A LOGWAY 30 ft. in the clear with a 20-ft. rise-and-fall movable crest is the most notable feature of the Island Lake storage reservoir of the Great Northern Power Co. This logway and an adjacent sluiceway are placed in an earth dam that raises the level of the Cloquet River 35 ft. and creates a lake with an area of about 12 square miles. The dam is located 18 miles north of Duluth, Minn. It impounds water from a drainage area of 546 square miles to help equalize the flow at the company's hydro-electric plant on the St. Louis River, into which the Cloquet discharges. The sluiceway mentioned discharges impounded waters when the river is low. Flood waters are passed by an independent spillway, built in one of two low dikes required to prevent the overflow of the reservoir into high swamp lands. The spillway discharges down a valley of low slope to the main river, a mile and a half away.

Hot Water Played on Winter-Built Earth Dam

The earth portion of the main dam has an upstream slope of 1 on 3. The downstream slope is 1 on 2 with a 6-ft. berm at about half the maximum height. Six-inch tile drains were laid on the natural ground surface under the downstream slope every 15 ft. along the embankment so as to discharge into a ditch at the toe of the slope. The material for the fill was excavated with a steam shovel from a neighboring hill above the pond level and was hauled in dump-cars by small locomotives to the site, where it was deposited in place. The fill was made in the winter and was kept from freezing by playing streams of hot water upon it. The embankment rises 10 ft. above the crest of the spillway and contains 84,250 cu.yd. of material.

Sluiceway Gate Stems in Oil-Filled Pipe To Prevent Freezing

Two reinforced-concrete retaining walls 55 ft. high and 60 ft. between faces make an opening through the embankment, the opening being divided into two parts by a middle wall. One part, the wasteway, contains sluices for discharging the impounded water when the river is low; the other contains the log sluice. The wasteway, which is 28 ft. wide, is closed by a vertical arch, 18 in. thick and of 14-ft. radius. In the bottom of the arch and below tail-water level to prevent freezing, are set five 4 x 8-ft. rectangular cast-iron sluice gates. Piers extend upstream from the face of the arch between each pair of gates to carry trash racks and to permit the use of stop logs, should the gates get out of order. Similar provision for stop logs is made downstream. The gates are hand operated by gate stands

from a platform at the elevation of the top of the embankment. To prevent ice from forming around the gate stems, each one is incased in a pipe that is filled with oil.

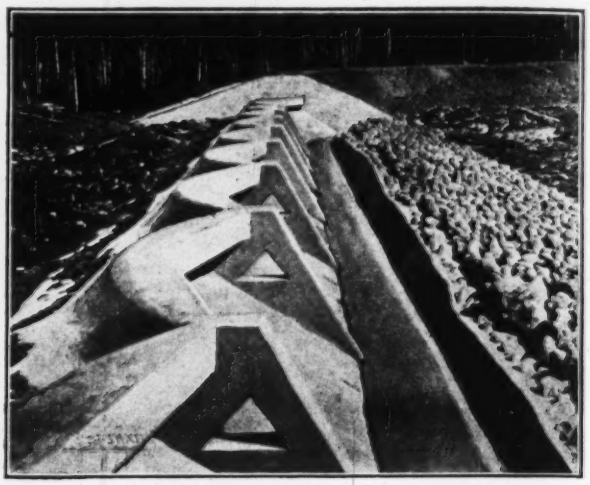
The other part of the opening, which is 30 ft. in clear width between walls, contains the log sluice, one of the most interesting features of the whole design. The lumber company, which controls the site, required a log sluice having a clear width of 30 ft. and a movable crest with a rise and fall of 20 ft. The ice conditions in northern Minnesota are very severe, and a type of gate was required which would not freeze up. After considerable study, the type of bear-trap dam was adopted. It is operated by admitting water to and discharging it from the space under the dam. Timber dams of this type on a small scale have been used successfully as log gates and were kept from freezing by allowing a stream of water to run through the operating chamber during the winter. The structure as built consists of two leaves connected by links, the open space at the links being closed by the idler, a third leaf hinged at one end and on rollers at the other. In the up position the crest is at the elevation of the crest of the spillway. The main leaves are hinged to a concrete floor that extends between the side walls about 25 ft. above the footings. The upstream end of the space under the floor is closed by three vertical arches. The floor and its supports have been designed in such a way that, should log driving on the river cease and the log gate be abandoned, a power house can be built in the opening with a vertical turbine on the floor and a draft tube beneath.

Raising and Lowering Dam in Logway

Connecting the pond upstream with the chamber under the gate are two 24-in. pipes furnished with gate valves. The flow through these pipes, together with the leakage around the sides of the idler and the upstream leaf, supplies the gate chamber with water for raising the gate and keeping it up. In the retaining wall next to the gate is a well communicating directly with the gate chamber by an opening through the wall. The well contains the operating valve and gives access to the gate chamber for inspection when the water in the reservoir is drawn down. In the bottom of the well is a conical opening discharging into tail water and closed by a vertical steel pipe 30 in. in diameter extending up to pond level. The pipe forms the operating valve and is lifted from its seat by a chain hoist to allow water to escape from the gate chamber and the gate to fall.

Normally, the upstream valves are kept open and the downstream valve closed. As the storage reservoir fills, the gate rises, the crest floating high out of water until it approaches the up position. When it is desired to sluice logs, the gate can be lowered by opening the downstream valve and letting water out from the gate chamber. As the head on the operating valve is much greater than on the inlet valves, the operating valve will pass a much greater quantity of water than the inlet valves; consequently, the inlet valves may be kept open at all times and the gate may be operated by the outlet or operating valves alone. In practice, however, it has been found that the gate works better if the upstream valves are closed during operation.

With regard to the design of a movable gate of this type, there are two positions that control. The gate must rise from its down position under the small head available and it must go down by the critical position when the link is at right angles to the downstream leaf, a position in which the idler tends to hold the upstream and downstream leaves apart. The first requirement can be provided for by making the structure light enough to float, the second by placing the upstream and downstream hinges a sufficient distance apart and making the link short. No exact solution of the problem is apparent, but a few trials determine a base length



THE SPILLWAY IS A LOW MULTIPLE-ARCH DAM

that will make a workable gate. Placing the link pin of the upstream leaf on the under side of the leaf aids materially in shortening the requisite base.

The size of the Island Lake gate was so great as to necessitate a steel structure; but the parts had to be small enough to allow hauling several miles over logging roads, and adapted to erection between vertical walls. A cellular girder construction was adopted for the downstream leaf. The girders are spaced 24 in. c. to c. and are 20 in. deep—large enough for a man to enter the cells and assemble the work. The leaf was shipped in five sections of two cells each, which were joined by cover plates in the field, so as to form the other four cells. The upper end of the leaf was closed by another girder that fitted over the end like a box cover. A manhole cover fastened by brass machine screws in the top cover plate at the end of every cell gives access to the interior of the leaf.

Upstream Leaf Had To Be Buoyant

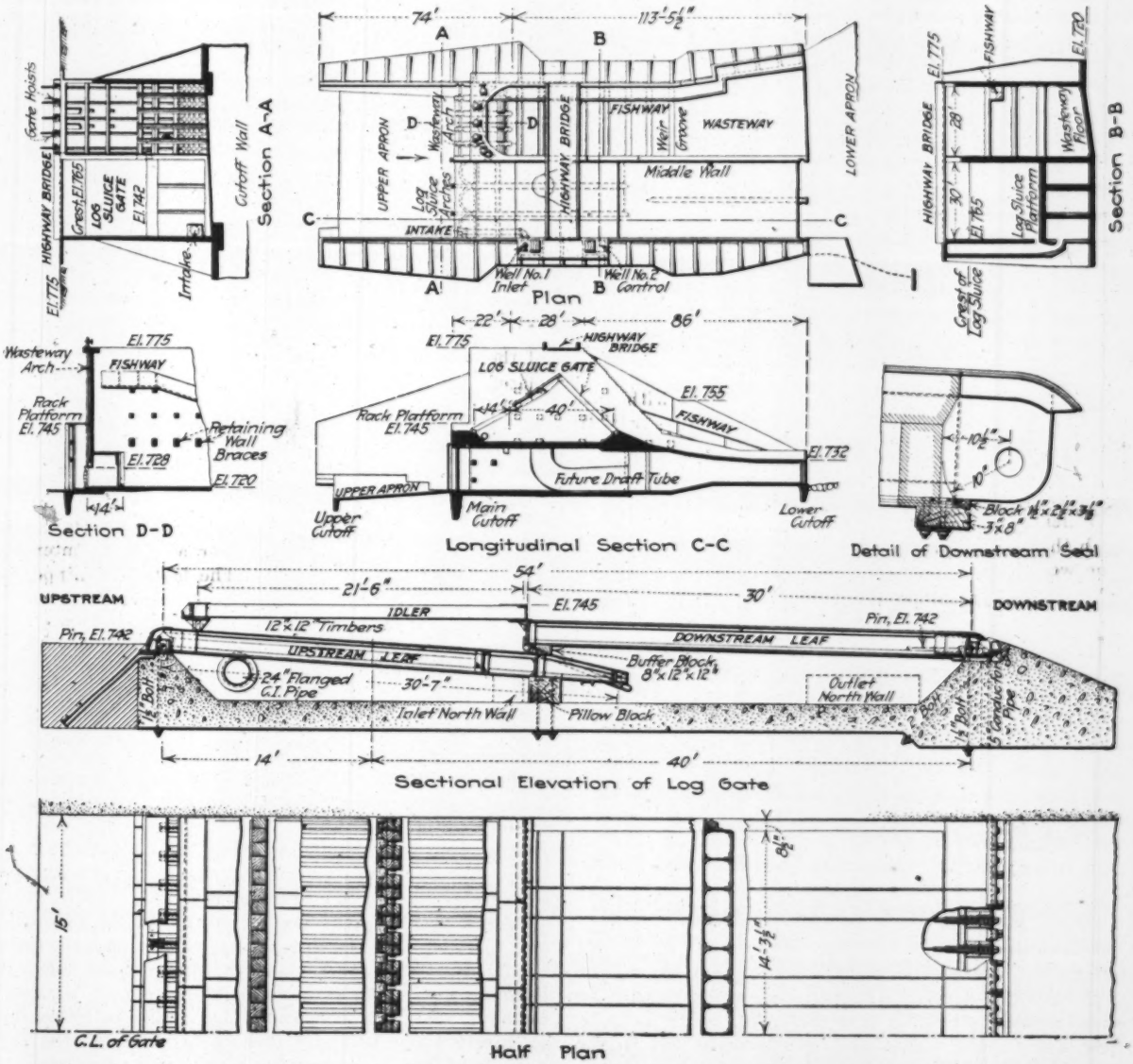
The same type of construction was not used for the upstream leaf, because the cells could not be kept from filling with water and it was necessary to make the leaf buoyant or nearly so, since the downstream leaf can exert but little lifting force through the link when the gate is down. Accordingly, the leaf was made of plate girders, 15 in. deep, with waterproofed timbers bolted to the sides between the flanges, 8 x 8's above and 10 x 10's below. These girders were spaced 24 in. c. to c., so as to align with the girders of the other leaf. The timbers were bolted on in the field before erecting the girders, and the spaces between the 8 x 8's were closed by other 8 x 8 timbers spiked in. A half-inch crack was left at each closing piece to allow for swelling.

Fourteen links made up of two angles with a U-plate bolted to each end connect the upstream and downstream leaves, the timber packing being cut short of the end of the girder to give space for the links. At one end the U-plate forms a slotted hole to prevent binding when the gate is down and to let the downstream leaf rise about a foot off the pillow block before the upstream leaf, which is somewhat lacking in buoyancy, offers any resistance. The link pins are 3 in. in diameter and are continuous, except that they were cut on the center line for convenience in shipping.

The idler, whose load is relatively small, was made of 12 x 12-in. timbers covered with ⅛-in. skin plates. The timbers are bolted to steel plates at each end, the upper plate being hinged to the downstream leaf and the lower plate resting on cast-iron carriages with cast-iron rollers that track on the flange angles of the upstream leaf. The spaces between the rollers and their carriages are filled with wooden blocks.

The design of the water-tight joints required more study than any other one feature. The downstream leaf forms one continuous piece and can leak only at the sides and bottom. It is the part that is relied upon to hold back the water. Leakage through the upstream leaf and the idler is not of importance so long as a difference in head of several feet between the gate chamber and the pond can be obtained when the gate is to be lowered. Accordingly, the upstream leaf and the idler were made to fit only fairly closely between the side walls, but more care was taken with the clearance.

The struts across the wasteway (see detailed drawing and view on front cover) take up the water pressure from the gate chamber against the middle wall. In the plane of the floor under the log gate are heavy struts to



ISLAND LAKE DAM HAS LOGWAY WITH MOVABLE DAM AND WASTEWAY FOR PASSING STORED WATER

Reinforced-concrete structure in earth dam. Steel bear-trap type of movable dam in logway carefully designed to give necessary water-tightness and buoyancy where needed

help hold apart the retaining walls, which have a narrower base than a gravity section would demand. Both sets are reinforced with structural-steel columns.

The fact that the downstream leaf must not be allowed to fill up with water, because of the buoyancy required to raise the gate from its down position, precluded the use of the usual cylindrical watertight joint attached to the top cover plate. Instead, cylindrical castings were attached to the pedestals, and the joint was made by a timber bolted to the bottom cover plate and rubbing against the castings. Leakage through the joint and into the downstream leaf is taken care of by drains through the base of the pedestal. To prevent the flow over the gate, when sluicing, from entering the inside of the leaf, the lower end of the top cover plate is made concentric with the pin and fits inside a casting bolted to the pedestal. The casting, which is made heavy enough to take the blow from a log, is embedded in the concrete floor. The curved plate can be detached to give access to the pedestal.

Multiple-Arch Spillway Dam

The spillway is a multiple-arch reinforced-concrete dam 12 ft. high from the top of footings to crest and 300 ft. long between retaining walls. The footings rest on boulders and gravel. A concrete cutoff wall 5 ft. deep at the upstream edge stops the underflow. The interior bays are 32 ft. c. to c. of buttresses, and the end bays are 38 ft. from the center of the buttress to the face of the retaining wall, the distance from crown to springing of the arches next the retaining wall being made longer to reduce the normal component of the thrust against the retaining wall. All the arches are circular cylinders, 15 in. thick, with a radius of 32 ft. The falling water is deflected by a reinforced-concrete slab containing steel I-beams that are carried by the main buttresses and a small intermediate buttress. At the bottom of the slab is a tumbling pool, and beyond it a boulder-and-reinforced-concrete apron extends downstream to prevent a flood from cutting under the structure. Ventilation of the sheet is provided through wells in the retaining walls and holes in the buttresses. The earth embankment is 7 ft. higher than the crest of the spillway, which has a capacity of about 15,000 cu.ft. per second.

The main dam and the spillway were completed in the spring of 1915, and the reservoir was partly filled shortly afterward. The log sluice has been tried out, and it worked in an entirely satisfactory manner.

Both the dam and the spillway were designed, and their construction was supervised, by Gardner S. Williams, consulting engineer, Ann Arbor and Chicago. The steel was fabricated by the National Iron Co., Duluth, Minn., and erected by E. S. Johnson & Co., St. Paul, Minn., who had the general contract for the work.

Reports 1000 Accidents Daily

An average of nearly 1000 accidents a day, excluding those which cause no loss of time other than the day or shift in which accidents happen and which require no other medical attention than first aid, occur daily in New York State. This fact was brought out in the annual report of William C. Archer, second deputy commissioner of the Bureau of Compensation of the State Industrial Commission.

Training City Managers

Special Relations to Public Health and Sanitation Suggest Plan of Education Along Broad Lines

By Murray P. Horowitz
Assistant, Department of Biology and Public Health, Massachusetts Institute of Technology, Cambridge, Mass.

According to statistics compiled up to Jan. 1, 1917, there were 99 towns and cities in the United States that were governed under the city-manager plan. Of these, 70% were cities with populations under 10,000, and 86% with populations under 25,000. It is becoming apparent that the city-manager plan is growing in favor, particularly among cities of the residential type. It seems almost certain, therefore, that in the near future there will be a demand for expert municipal managers, which means that such managers ought to have special training and that our highest institutions of learning, especially our engineering schools, should recognize and meet this demand.

Modern health activities have become so wide in their scope that they touch the community in most of its vital parts. Public health today is applied biology in its highest and most interesting form, dealing with the effects of varying factors on the health, welfare, comfort and convenience of the people. A safe and adequate water-supply is essential to the life of any community; likewise, proper and adequate means of sewage disposal. The control of the city milk supply and other food materials is also essential. The removal and disposal of garbage, refuse and ashes frequently also demand the attention of the health official, particularly in the smaller communities. Lately there has developed a realization of the important relationship between the public health and industry, economics and sociology. This includes such subjects as industrial hygiene and sanitation, wages, hours of employment, poverty, alcoholism, the improving of the condition of the poor, school hygiene and sanitation, recreation, protection against street accidents, the establishment of comfort stations, and many other activities.

Public-Health Training Points the Way

The interest of the health official is thus apparently very wide and all inclusive. The importance of this and the realization of the necessity to train men for this work, were recognized very early by W. T. Sedgwick, professor of biology and public health at the Massachusetts Institute of Technology. Many of the leading health workers throughout the country have obtained their training under him. The time is now ripe to take another step forward and to bring the training in sanitary science to even greater service to the community by training men to be city managers.

Before outlining the plan of education for the town manager, let us observe what his duties and interests should be. The town manager must be an efficient business man, with a thorough knowledge of business methods. He must have knowledge of and be interested in effective and adequate transportation facilities, fire protection, police protection, health protection, water-supply, milk supply, food supply, sewerage and sewage disposal, garbage and refuse collection and disposal.

street cleaning, street lighting, street paving, parks and recreational facilities, markets, relief work and other civic activities. The town manager should also have knowledge of the principles of government. Neither is it hoped for nor desired that the town manager shall be an expert in all these various fields. But it is expected that he shall have at least a knowledge of the important principles of these different activities.

It is realized that, although the training offered in the department of biology and public health at the Massachusetts Institute of Technology fits one for activity in many of these fields, yet it falls short of the requirements of the new and larger profession. But it is possible to formulate a course that may be molded about such training offered in the department of biology and public health, which will develop trained and efficient town managers. The writer proposes to show how this may be done by combining work in different departments at a school like the Massachusetts Institute of Technology.

Composite Graduate Course Suggested

This course should be a graduate course, given jointly by the departments of biology and public health, civil and sanitary engineering, and economics and statistics, and should lead to the degree of bachelor of municipal engineering. The following courses are taken from the 1916 catalog of the Massachusetts Institute of Technology and give an idea what the proposed course should consider. Any person interested may obtain a better idea of the nature of the courses by consulting the catalog.

SUGGESTED COURSES FOR DEGREE OF BACHELOR OF MUNICIPAL ENGINEERING

Course No.	
	Department of Biology and Public Health
731	Elements of bacteriology
733	Bacteriology of air, water and food
738	Public-health laboratory methods
739	Biology of water and sewage purification
742	Bacteriology in relation to refrigeration, canning and food preservation.
743	Control of city milk supplies
751	Biology of infectious diseases—II
753	Industrial hygiene and sanitation
755	Public health problems
756	Principles of sanitary science and public health
757	Public-health practice
762	Sanitation of houses and public buildings
770	Public-health field work
772	Sanitary law
773	Public-health administration
780	Journals
	Department of Civil and Sanitary Engineering
130	Highway engineering
137	Highway specifications
175-6	Hydraulic and sanitary engineering
177-8	Sanitary engineering
181	Engineering of water and sewage purification
190	Vital statistics
199	Specifications and contracts
	Department of Economics and Statistics
35	Transportation
38	Securities and investments
45	Labor problems
58	Business management
60	Business law
70	Taxation
	Department of History and Political Science
38	Municipal government

Courses dealing with municipal markets, organization of charity and relief work and any other matters that may be found necessary to consider, should be added.

It would be advisable to have several series of three to six special lectures given by experts, in their particular specialties. In this way the special problems related to the general activities of a town manager may be adequately considered.

The students must of necessity be mature men, preferably about thirty years or over. They should be men who already hold an academic degree. They should also have had training along engineering lines. Experience in municipal work would of course be an asset. Candidates in this new course should be men of pleasing personality and good address. They should show tact, intelligence, executive capacity, the ability to write well, speak well and to meet people. They should of course be honest and energetic and possess the ideal of service to the community.

The course itself should require at least two years residence, ending with a special piece of work in the field. There may be added later a course leading to the degree of doctor of municipal engineering, which will require longer residence and more intensive work and research.

It is hoped that the above plan or one similar to it will be adopted in the near future by some high institution of learning, like the Massachusetts Institute of Technology. The need for such trained men is already felt and will become more pressing in the future. Furthermore, it represents an effort to bring municipal administration out of politics as much as possible and to place such government on an honest and efficient basis, with the ideal of community service paramount. An accomplishment of this nature would be a boon to the people of this country.

Connecticut Controls Disinfectants

An act designed to control the strength of disinfectants used in Connecticut by providing for testing and labeling any put on the market was passed by the last session of the legislature and takes effect Aug. 1, 1917. The act is designed to cover all disinfectants which can be standardized by comparative tests with carbolic acid, we are informed by John T. Black, Commissioner of Health for Connecticut. It will thus not include formaldehyde, Dr. Black states, but does embrace all the coal-tar and other common disinfectants in use. The act reads as follows:

"The receptacle containing any disinfectant for external use the phenol coefficient of which can be determined by a bactericidal test, manufactured, sold or offered for sale within the state shall bear a label showing the carbolic acid coefficient or relative germicidal value of such preparation as compared with pure carbolic acid. The relative germicidal value of a disinfectant shall be determined by the application of either the Rideal-Walker or the Hygienic Laboratory method. Any such disinfectant shall be misbranded if the statement contained on the label is false. Any person who shall misbrand any disinfectant within the meaning of this act or shall sell or offer the same for sale shall be fined not more than $100 or imprisoned not more than 60 days, or both."

Discolored Maple Has Low Shock Strength

Two pieces of maple received from the National Hardwood Lumber Association, one of which was badly discolored, were tested at the Forest Products Laboratory. Where slowly applied loads were used, the two samples were about equal in strength; but in resistance to shock the discolored piece was decidedly inferior. A microscopic examination showed the cell walls of the discolored piece to be partly destroyed by fungi.

Fire-Wrecked Concrete Building Repaired for Service

Columns and Floor Units of Far Rockaway Warehouse Replaced or Repaired So Building Is Now in Use

IN NOVEMBER, 1916, a fire in an adjoining frame structure worked its way into the interior of a reinforced-concrete building operated as a warehouse by Mullen & Buckley at Far Rockaway, Long Island, and in the comparatively short time before it was put under control caused structural damage of considerable importance, although the property loss of the contents was small. The fire was noted in *Engineering News*, Nov. 9, 1916, p. 956, and a very complete report by Ira H. Woolson, of the National Board of Fire Underwriters, was afterward abstracted in both *Engineering News* and the *Engineering Record*. At the time of the fire the local building authorities decided that the damage was

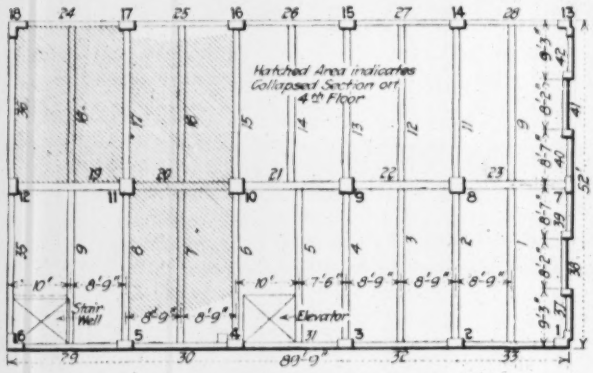


FIG. 1. TYPICAL FLOOR PLAN

so great in certain parts of the building as to demand the tearing down of most of the structure. In fact, the day after the fire a photographer was permitted by the building authorities on watch to take an interior flashlight photograph only after long pleading and the assurance that he did it at his own risk. These watchmen apparently felt that the force of the flashlight explosion would be sufficient to tip the tottering structure to the ground.

It was readily evident to experienced observers, however, that the damage to the structure, while locally serious, did not endanger the safety of the structure, and that by utilizing similar methods to those used in the reconstruction of the Edison buildings at West Orange, N. J., the building for comparatively small cost could be put back into service. This work has just been completed, under the direction of Morrell Smith, the architect for the building, by the Moyer Construction Co., 375 Fulton St., Brooklyn, N. Y. Mr. Moyer has put at the service of *Engineering News-Record* the details from which the following description of the reconstruction was prepared.

A typical floor plan of the seven-story and basement building is shown in Fig. 1. The damage to the structure, as shown by complete examination after the fire, consisted in many localized cracks in the walls and in the roof parapet, in the complete collapse of three panels of the fourth floor noted on the plan, in the shearing through of Column 11 on the third tier and its partial failure or cracking all the way up to the roof due to the settlement on the third floor, a similar but less pronounced failure in Column 8 at the other end of the building, and the extensive spalling of the fireproof protection of the concrete from the under side of a number of beams throughout the building.

The structure was rectangular in plan, 52 ft. by 89 ft. 9 in., with two cross bays and five lengthwise bays subdivided by beams and girders as shown in the plan. The beams were reinforced with Kahn wing bars, the floors with a wire-mesh mat and the columns with straight rods bound by occasional ties.

The repairs consisted in the pointing up of all exterior cracks, the complete replacement of the collapsed portion, the plastering up to a former or enlarged section of the spalled beams and columns, the replacement where necessary of new flooring surface, and the entire replacement of the roofing, and in certain places the strengthening by steel-bar hangers of certain members detached by cracks from their former position.

Repairs Classified

These repairs may be classified under the heads noted in the accompanying tabulation. The beam and column numbers refer to the numbers as given in Fig. 1. The specific work noted under those headings is described below.

New Beams—On the fourth floor it was necessary to replace entirely the beams and floor in the sections which collapsed. The work is shown in detail in Fig. 3. What was left of the concrete in the beams and girders after the fire was removed entirely, but the steel was allowed to remain and was forced back to its original position as nearly as possible. Pockets were then cut in the adjoining columns (Cols. 10, 11 and 12) to a

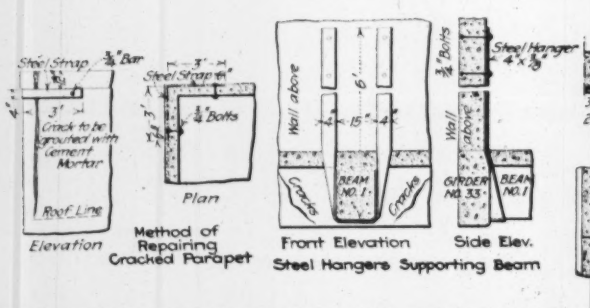


FIG. 2. REPAIRS ON FIFTH, SIXTH AND SEVENTH FLOORS

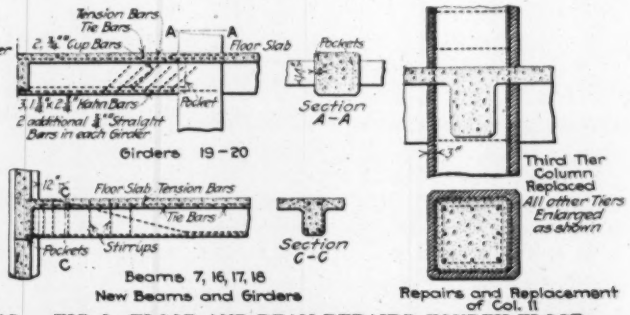


FIG. 3. FLOOR AND BEAM REPAIRS, FOURTH FLOOR

depth of 4 in. and to the full size of the main girders, and additional rods placed in the box forms for the girders, these rods extending into the pockets made. Framing into these girders steel and forms for the cross-beams were placed as for new construction, except that the steel for Beam 17 was left in place. The extra reinforcement in the way of longitudinal angles bolted to the floor slabs, as shown in the details, was placed. For the girders this reinforcement consisted of two rows of angles, one under the slab and one at the bottom of the girder; for the beams only the angle under the slab was placed. Concrete according to the

DETAILED MEMBERS REPAIRED OR REPLACED IN FAR ROCKAWAY CONCRETE WAREHOUSE DAMAGED BY FIRE

	New Beams	Repaired Beams	Patched Beams	New Columns	Repaired Col.	Patched Col.	Miscellaneous
Roof			1, 2, 4, 14				New Roofing
7th floor		1, 33			11		Parapet Strapped Together
6th floor		1, 33			11		
5th floor		1, 33	3, 4, 23, 31, 32		11		
4th floor	7, 16, 17, 18, 19, 20	2, 3, 4, 5, 6, 8, 9, 12, 13, 14, 15, 21, 22			11	Pilaster 3	
3rd floor			1, 33	11			
2d floor			1, 33				
1st floor							

floor slabs were then reinforced as shown in the drawings, and the whole panel poured as though it were a new structure. The steel in the sections was figured as though the beams were T-beams with free ends taking a live-load of 120 lb. per sq.ft. The floor slabs were 5 in. thick, reinforced with ½ x ½-in. tension bars, 9 in. on centers, with two tie bars ½ x ½ in. in each panel. The concrete was a 1:2:4 mixture.

Repaired Beams—The repaired Beams 1 and 33 are at a corner of the building, where expansions under heat seem to have caused a continuous crack from the

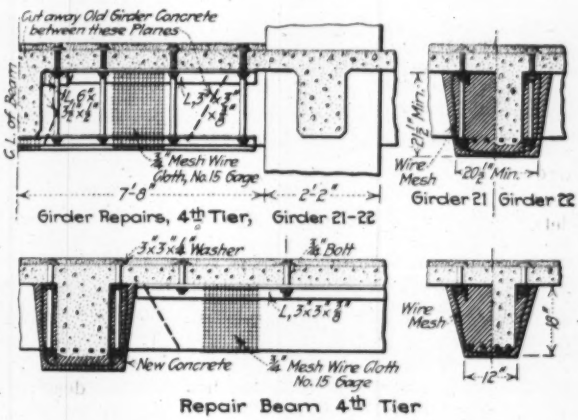


FIG. 4. THESE BEAMS AND GIRDERS WERE HEAVILY SPALLED BY THE FIRE

second to the seventh floor. On the fifth, sixth and seventh floors these beams were repaired as shown in Fig. 2. That is, steel-plate hangers were fastened to the side wall by bolts and hangers passed down through the floor and around the bottom of Beam 1, thus suspending that beam from the wall above and making it independent of the Girder 33, which in all these three floors showed cracks about as in the location noted in the drawing. As noted further below, on the second and third floors at this location the cracks were of minor importance and were merely patched up.

Under the heading, "Repaired Beams," of the table, Girders 21 and 22 and Beams 2 to 6, 8 to 9, and 12 to 15, all on the fourth tier, were repaired as shown in Fig. 4. These beams and girders were very heavily spalled by the fire, but not so much that it required the entire removal of the concrete. The beams were gone over thoroughly with a hammer, and all loose concrete was removed. A form was placed around them and sections shown was then placed by pouring through a hole cut in the floor above. This new concrete was composed of 1 part cement, 2 parts sand and 2 parts No. 1 grit, and the additional section was bonded to the old by a wire mesh hung around the angle reinforcement.

Patched Beams—All the beams noted under the heading, "Patched Beams," were repaired by plastering concrete to the original section over the whole section after that had been cleaned of the spalled concrete by hard hammering. This was, in effect, merely the replacing of the fireproofing.

New Columns—One tier of one column had to be entirely replaced; that is, Column No. 11 on the third floor. Here the column, which was originally 26 x 26 in. square, was cut off flush with the floor and with the ceiling, the floor above having previously been strutted. The steel bars were cut off 1 ft. above the floor and 1 ft. below the girder bottom. A new column was then placed according to the section shown in Fig. 3, 28 x 28 in. square with eight ⅞-in. steel vertical rods tied with ¼-in. steel ties 12 in. on centers. For this same column on the floors above, the old surface was hammered off to a hard bottom and additional reinforcement, consisting of four ⅞-in. steel bars, was placed vertically and tied with ¼-in. steel rods 12 in. on centers. Forms were then erected and 3 in. extra of concrete, as shown in Fig. 3, was added to the column section through all the floors. The new concrete was composed of 1 part cement, 2 parts sand and 2 parts grit.

Additional work consisted of tying together the parapet wall, according to the detail shown in Fig. 2, where it had cracked at its corners. The steel strap was bolted around the corner of the wall and the cracks filled up with grout.

The work of repairing the building was done by the Moyer Engineering and Construction Co., of Brooklyn, N. Y., after plans prepared in its own office, and under the direction of Morrell Smith, architect, of Far Rockaway, the designer of the building.

Drifting-Sand Water Filters for Oshawa

A contract has been let by the town of Oshawa, Ont., for an installation of drifting-sand filters similar to those now nearly completed at Toronto, Ont. The Oshawa filters will be built of reinforced concrete; otherwise they will be like those at Toronto (see *Engineering News*, Sept. 21, 1916, page 566). About two-thirds of the Toronto plant is in operation, but no official tests are yet available.

Cantilever Concrete Bridge Has Suspended Link

Put Light Structure of Arch Form on Pile Foundation So Settlement or Dynamite Can Affect One Pier Only

IN APPEARANCE an arch, actually a cantilever type, each unit supported by a pier, the 2200-ft. reinforced-concrete bridge proposed to connect Belle Isle with Detroit will consist of 19 spans, each made up of cantilevers extending out from the piers and supporting at their ends a suspended beam section. Except for the latter feature the structure will be somewhat similar to the 2280-ft. Hanover St. bridge in Baltimore, described in *Engineering News*, Mar. 29, p. 497.

The original steel bridge, 2956 ft. long, of 12 spans 156 ft. long, a pivot span 318 ft. and five 88-ft. pony spans, costing $295,000, was destroyed by fire in April, 1915, as reported in the *Engineering Record*, May 8, 1915, p. 599, and *Engineering News*, May 6, 1915, p. 906. As the traffic to this most beautiful park of the city is extremely heavy, a temporary pile bridge with 22-ft. roadway and two 7-ft. walks was built in 1916 at a cost of $100,000. It was assumed that this would last until the necessary plans, bond issue, court proceedings and construction on the proposed new structure of monumental type could be built. The accompanying drawing shows the novel features in the design. Live-loads assumed were 50-ton steel cars on two tracks, an 18-ton road roller, 100 lb. per sq.ft. on the roadway and 100 lb. on the sidewalk. Some of the reasons for the design are given below.

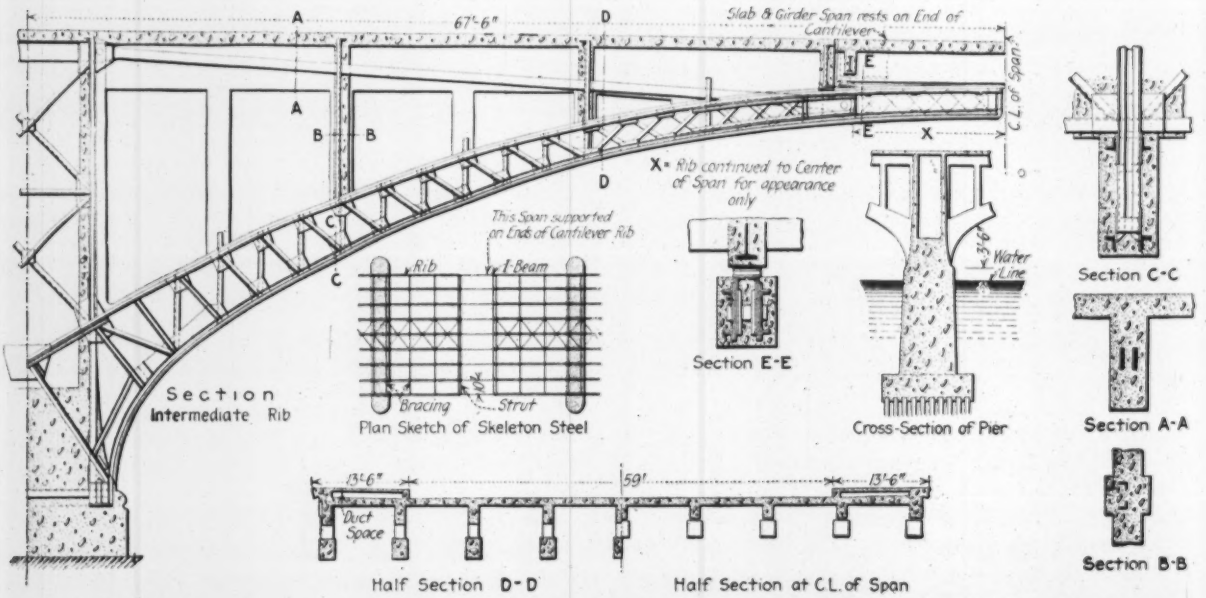
The total width of the bridge will be 86 ft., a roadway of 59 ft. and a 12-ft. sidewalk on either side. The proposed width of roadway is about the same as North Woodward Ave. or Fort St. near the City Hall, or about 10 ft. less than Jefferson Ave. at the site of the bridge. The roadway width of the new bridge is adequate for three lines of traffic either way, and the sidewalks are each capable of delivering 15,000 people per hour. The maximum clear headroom for boats under the bridge will be 30 ft. This clearance allows for the passage of all tugboats and other river traffic, except the large private yachts having masts more than 30 ft. in height.

Dynamite Cannot Wreck It

As regards stability, it will be impossible to wreck the bridge by dynamiting any single pier, nor would the settlement of one pier have any detrimental influence on any other pier or on the structure as a whole. In an arch structure each span would be dependent on its neighbor for stability, and the destruction of one span would likely result in the collapse of the entire bridge. This type also lends itself better than any other to the possibility of introducing a drawspan, if at any time in the future such a span should become necessary.

The type of structure was determined largely by foundation conditions. Soil examinations show 90 ft. of soft blue clay before one encounters any sort of satisfactory foundation material. The distance to rock, presence of poisonous gases in the soil and the character of the material render foundations to rock inadvisable. The conditions require that the structure be supported on piles and be made as light as practicable, consistent with strength and attractiveness.

The present boulevard approach is 200 ft. wide and is adequate for all vehicular and pedestrian traffic and a street-car terminal. To relieve the traffic congestion on Jefferson Ave. during rush hours, a subway is provided under the avenue of sufficient width for four lines of traffic. The width of the boulevard is such that a subway can be constructed, and in addition there will be a roadway on either side, each sufficient for two lines of traffic. During the major portion of the day, automobiles may turn onto the bridge approach from Jefferson Ave., but during rush hours they will be required to pass through the subway, thus avoiding interference with the regular traffic east and west on Jefferson Avenue—a very much needed arrangement at this point.



PROPOSED TYPE OF REINFORCED-CONCRETE BRIDGE ACROSS DETROIT RIVER TO BELLE ISLE

At the island end a separation of automobile and pedestrian traffic has been accomplished in a manner similar to that at Jefferson Ave., by means of easy inclines. The pedestrians pass down and under the automobile driveways and thus safely reach the inside of the automobile loop on the island without interruption of traffic. This terminal is also planned so as to allow the use of street cars operating under a shuttle system.

It has been considered very desirable, in view of the nature and amount of the river traffic, to eliminate the drawspan. The opening of the drawspan introduces a serious interruption to traffic over the bridge and entails a considerable sum annually for operation and maintenance.

The Lake Carriers' Association will make no protest, as the 1500-ft. main channel on the opposite side of the island is considered entirely adequate for all present and future anticipated needs. Sanction, however, must be obtained from the War Department. Detailed estimates as submitted at a public hearing last November indicated that at the prices then current the cost would be $2,000,000, of which one-half will go into foundation. The war situation has deferred action on a bond issue by the city officials for the present.

The plans were prepared following the request to the City Council by the Detroit Engineering Society to appoint a bridge commissioner. The consulting board so constituted consisted of M. E. Cooley, chairman, F. C. McMath, W. R. Kales, H. E. Riggs, E. Lorch, architect, and L. M. Gram, engineer. The plans were prepared under the general direction of George H. Fenkell, commissioner of the Department of Public Works, and the consulting board. Louis E. Ayres is engineer of the Belle Isle bridge division of engineering and construction.

Ohio Falls Into Line

The Ohio State Board of Health was succeeded on July 1 by a Department of Health consisting of a Commissioner of Health and a Public Health Council of five, of which the commissioner is a member. The council is specifically barred from exercising either "executive or administrative duties," these being vested in the commissioner. The four members of the council other than the commissioner are appointed by the governor and receive compensation of $10 a day "while in conference," with reimbursement of expenses.

The commissioner is appointed by the council, subject to approval by the governor, and receives a salary established in the same way. He must "be a physician, skilled in sanitary science," must give his full time to the work and is appointed for a term of five years. Two of the members of the council must "be physicians, who shall have had training or experience in sanitary science." The principal duties of the council are to make and amend a sanitary code, applicable throughout the state; to take evidence on appeal from decisions by the commissioner of health as to "the approval or disapproval of plans, locations, estimates, or cost or other matters heretofore required to be submitted to the State Board of Health for approval"; and to fix the number of divisions and the qualifications of directors of divisions of the department.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

An Active State Society

The Illinois Society of Engineers maintains active connection with engineering development throughout the state. It has supported the good-roads movement and the work of the State Highway Department. It has assisted in the movement for arousing greater interest in land drainage, lending its aid to the drainage conferences held at the University of Illinois. These movements are not confined to engineering features, but aim at general publicity and promotion. For this reason the society has established sections dealing with special branches, membership in these (but not in the society proper) being open to nontechnical men who are interested in the work. Thus, the drainage section aims to enlist drainage commissioners, landowners, contractors and lawyers who make a specialty of drainage cases. The sewerage section also is open to superintendents and men in charge of sewerage work or sewage-treatment plants.

Oregon Society To Try Local Chapters

The Oregon Society of Engineers has set itself the task of organizing engineering opinion on matters of public interest. An active spring campaign was conducted to develop coöperation among engineers. A systematic series of lectures and published reports has aroused much discussion, and has proved of value in bringing engineers into close contact with public questions. Among the subjects recently discussed by prominent speakers are, "The Wooden Ships as Proposed by the Emergency Fleet Corporation," "The Oregon $6,000,000 Road Bond Issue," "The $3,000,000 Bond Issue for Harbor Improvement in Portland" and "The New Portland Building Code," the latter being a discussion having special reference to æsthetics. The last spring meeting was held June 28.

An important change in the constitution permits the formation of local chapters in the smaller districts of the state to coöperate with the parent society. The society is about to conduct an engineering prize story contest, for a cash prize, as a means of further stimulating interest in organization activities.

Iowa Tackles Legislature Successfully

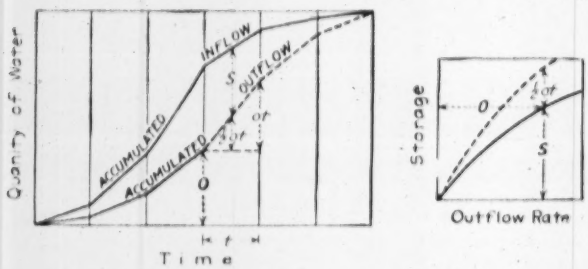
The shaping of legislation has been the most active interest in public affairs recently in the Iowa Engineering Society. The society has succeeded in having passed much-needed legislation of engineering interest, and corrections to statutes already on the books. In the last effort a bill on licensing engineers nearly passed, but failed from lack of interest. T. S. DeLay, who has been chairman of the committee for the last few years, believes the bill was too long, and two years hence a much shorter one will be drafted. Apathy on the part of members in not prodding up their representatives is also blamed.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Flood-Retarding Reservoir Problem Directly Solved

Sir—A problem often encountered in flood-prevention studies is to determine how the flood flow of a stream will be affected by the construction of a retarding reservoir. The nature of this problem and the usual method of solving it are outlined in the following words in an article on "The Miami Valley Flood-Protection Work" in *Engineering News* of Feb. 1, 1917: "The rate of outflow from the basin in a flood depends on the height to which the basin is flooded. This height in turn depends on the volume stored, which is the difference between the inflow and the outflow. Thus the quantities involved are inter-related. The problem of computing



STORAGE-OUTFLOW CURVE (FIG. 2) CAN BE PLOTTED FROM ACCUMULATED-FLOW CURVES (FIG. 1)

the outflow had to be solved by trial and error." This method of working is inconvenient and laborious. It may be avoided by the use of the solution given below.

Notation: t = any short interval of time during the flood; o = rate of outflow from reservoir at any instant, or during interval t; O = total or accumulated outflow up to the beginning of interval t; S = total quantity of water stored in reservoir at any instant, or at the middle of interval t.

Given: (a) The original time-flow curve or flood-hydrograph of the stream, giving the rate of inflow into the proposed reservoir at each instant during the flood considered. (b) The depth-storage curve of the reservoir, giving the total quantity S of the water stored in the reservoir when the surface is at any given elevation. (c) The depth-outflow curve of the reservoir, giving the rate o of the outflow from the reservoir when the water surface is at any given elevation. This curve will be approximately parabolic if the outlet is a tunnel.

Required: The new time-flow curve for the stream as modified by the proposed reservoir, giving the rate o of the outflow which would pass from the reservoir during each instant of the flood considered.

Solution: From the original time-flow curve of the stream plot a curve of accumulated inflow at successive instants during the flood, as shown in Fig. 1. This curve is the "mass curve" for the stream during the flood considered. Erect ordinates to this curve, spaced at a uniform time interval t so small that the curve will not vary sensibly from a straight line between ordinates.

Using the depth-storage and depth-outflow curves, construct a storage-outflow curve for the reservoir, as shown in Fig. 2, and on the same sheet construct another curve whose ordinate corresponding to any outflow o is $S + \frac{1}{2}ot$.

In Fig. 1, if the accumulated outflow O is given at the beginning of any time interval t, the outflow curve may be extended through that time interval without the use of trial and error methods by taking from Fig. 2 the outflow rate o corresponding to the value of the quantity $S + \frac{1}{2}ot$ as scaled from the middle of the time interval t in Fig. 1, and multiplying this rate by t to obtain the outflow ot during the interval. The method applies without change to the first time interval of the flood where O is zero. The operations may be carried out in tabular form if desired, without drawing the curves.

When the accumulated-outflow curve has been completed in the manner described, the desired outflow hydrograph of the stream may be readily obtained from it.

HAROLD A. THOMAS,
Associate Professor of Civil Engineering,
Terre Haute, Ind. Rose Polytechnic Institute.

Army Camp Bunkhouses

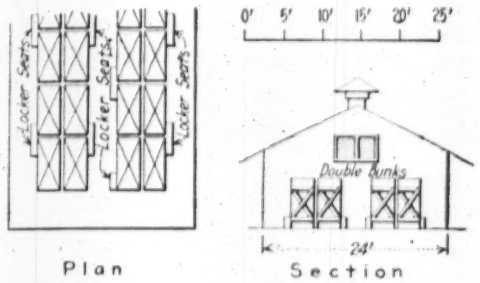
Sir—While it is assumed that the authorities have already decided on the details of design for the buildings that are to house the new army which is to be raised under the selective draft, it is considered possible that a discussion of experience gained in large construction camps might still be profitable. The design submitted by Frederick J. MacIsaac and printed in the June 14 issue of *Engineering News-Record* shows a number of details which have been worked out in his experience, but this design is lacking in one feature which is essential to health—good ventilation.

From the remodeled box-car to the typical logging camp, it has been almost the universal custom to range the bunks along the sides of a long, narrow structure, depending on openings at the ends, and sometimes on windows opening directly off from the bunks to secure ventilation. The plan submitted by Mr. MacIsaac is an improvement on these in that it provides for a wide space through the center with ventilators in the peak of the roof, but it still leaves much to be desired in the facilities for insuring an ample supply of fresh air to each of the bunks. An attempt to secure fresh air through windows in the side walls, opening directly from the bunks, will result in a "feast or a famine," as the man most directly affected will surely close the window during cold or stormy weather.

A plan which the writer prefers is shown in the accompanying sketch. This is considered to be a minimum spacing arrangement. It would be greatly improved by providing wider spacing between the double rows of bunks and also making each alternate cross-space wide enough to permit passage between. As shown, the use of double-deck steel bunks is contemplated, with a 6-in. space between the adjacent bunks. Each bunk to accommodate only one man. It is possible that the writer's experience as a volunteer in the Spanish-American war, when six men were quartered in a

7x9-ft. tent, has something to do with his idea that each man should be given a separate bunk.

By this minimum spacing, it is possible to secure housing at the rate of 21 sq.ft. of floor space per man, exclusive of area of cross-alleys. It is to be noted that the width of the building is 24 ft., a dimension that permits the use of lumber of ordinary commercial sizes, with little waste. The roof of such a building can easily be constructed without providing any interior supports. Ventilators of generous dimensions should be placed in the roof at frequent intervals. Fixed slat ventilators in each gable should be installed, and these should remain open at all times. Along each side of the building, stock check rail windows should be placed. It is recommended that these should be completely covered by outside screens to permit the opening of windows at either top or bottom without permitting the entrance of insects. Similar windows should be placed at each side of the central end doors.



SUGGESTED PLAN FOR MILITARY BUNKHOUSE

Spaces between windows in the side walls may be utilized for hanging clothing and equipment. For more permanent quarters, the building should be increased in width to permit the installation of lockers along the side wall. The only locker space provided in the accompanying plan is under the 12-in. by 4-ft. "locker seats," which will be utilized by the men in dressing and by the occupants of the upper bunk for mounting into their bunks. All bunks should be of metal and should be fastened to the floor so that they may not become accidentally displaced, but may be easily detached if required.

Each section of four double bunks will furnish quarters for one squad. This arrangement permits the quartering of men under their normal arrangement in the company unless separate quarters are to be provided for all noncommissioned officers. It is considered desirable in a camp of this nature that no movable articles of furniture be permitted in the quarters. Under military administration, it should be possible to keep as many of the windows of such a building open as may be consistent with the existing weather conditions.

The writer does not agree with Mr. MacIsaac's recommendations as to abbreviated eaves, it being considered that the advantage of a wide overhang would more than offset any trouble that might be occasioned by the formation of ice. This would be especially marked in a warm climate, but should also apply in northern sections as there are several months of the year in any section of this country when hot-weather conditions prevail. A generous overhang keeps the sun from the sides of the building for the most of the day and assists in keeping the building cool.

Where necessary to heat the sleeping quarters, spaces at proper intervals should be provided for heating stoves though these should not be required in the milder sections as reading rooms, washrooms and other facilities will doubtless be provided in special buildings.

In the training of an army, the physical well-being of the men is of prime importance. Nothing is to be gained by exposing them to unnecessary hardships, especially during the time that they are resting. Their fitness to withstand the necessary hardships of campaign life will be secured by thorough drilling and not by sleeping in poorly ventilated quarters and in uncomfortable beds. The experience of the European armies shows the danger of the development of tuberculosis in camps; and if it is impossible to guard against in trench life, it is more important then that no efforts should be spared to give the men an even start by insuring them as fully as possible against this malady by providing them with good quarters during their period of training.

ARTHUR M. SHAW,
New Orleans. Consulting Engineer.

Pacific Coast Defense League Defended

Sir—Gen. H. M. Chittenden in his letter published in *Engineering News-Record*, July 12, 1917, p. 81, tries to give the impression that the Pacific Coast Defense League is asking for a military road to "lie practically all the way along the immediate coast line." Had he followed the newspaper reports of the project and studied the legislation now before Congress at the instigation of the league, he could have easily learned that it is defining no route. It is leaving the location of whatever military roads the Government decides to build out here entirely in the hands of the War Department; in the hands of men eminently capable of locating roads from a strategic standpoint.

I have not read your article referred to, which so sarcastically assails all good-roads promoters who are masking their efforts to rob the treasury of the United States under the guise of military roads, and I have no doubt that it is a just and emphatic criticism. I am glad to see or hear of such fearlessness on the part of your paper. But this does not deter us in the least from calling the attention of Congress to the absolutely defenseless condition on the Pacific Coast and to the further fact that our railroad facilities on this coast are inadequate for any military operations and the mobilization of troops. Very unfortunately for us, the industrial development of our district has not been great enough to warrant the same railroad development as on the Atlantic Coast, and we decry the attempt to insinuate that the same conditions for defense exist here as on that coast. Nevertheless, we feel that we have wealth enough and are important enough to deserve defense, and that is what we are asking the Government to give us.

Permit me this suggestion: The Pacific Coast Defense League is officered by men who are keen and capable of judging conditions for themselves; they are men of the highest business standing and men who have studied the defensive conditions on this coast for years.

They are men upon whom the Government relies in more ways than one and are men who are keenly interested in the future of the Pacific Coast. Our sole object is not good roads or military roads, but a comprehensive defensive system on this coast, and we stand ready to assist the Government in any way possible to accomplish this.

R. W. EMERSON,
Secretary, Pacific Coast Defense League.
Seattle, Wash.

Stitch Rivets Spaced for Bending

Sir—Edward J. Squire, in *Engineering News-Record* of June 21, p. 616, apparently overshoots the mark when he finds

$$Sb = 1004 \text{ lb. per in.}$$

and on the assumption of ⅞-in. rivets with a value of single shear = 7220 lb.,

$$p = 7.2 \text{ in.}$$

His results are due to what appears to the writer an arbitrary establishment of a bending moment, $\frac{w}{8}\left(\frac{L}{2}\right)^2$, as causing the unit stress of $70\frac{L}{r}$ lb. on the extreme fibers.

It is reasonable to assume this unit stress of $70\frac{L}{r}$ lb. on the extreme fibers being produced by a uniform load of w pounds per inch (not per foot as Mr. Squire inadvertently states) over the span L (in inches). The maximum bending moment produced by this unit load w, the strut considered as a beam with fixed ends of span L, is the (negative) one at the ends = $\frac{1}{12}wL^2$. (The positive moment at the center of span is $\frac{1}{24}wL^2$.) The maximum bending moment and the maximum shear are at the ends of the strut. Retaining Mr. Squire's symbols throughout, we have

$$\tfrac{1}{12}wL^2 = 70\frac{L}{r} \times \frac{Ar^2}{c}$$

Substituting W for wL (the total load) and solving for W, we have

$$W = 840\frac{Ar}{c}$$

and

$$V = \frac{W}{2} = 420\frac{Ar}{c},$$

making the shear and the rivet pitch for the given example

$$Sb = \frac{420 \times 4.87}{1.45 \times 3.75} = 376 \text{ lb. per in.}$$

$$p = \frac{7220}{376} = 19.2 \text{ in.}$$

The 19.2-in. pitch applies only near the ends of the strut, as the shear toward the middle decreases to 0, but to use this pitch throughout is a trifling extra expense and is on the side of safety.

It *should not be overlooked* that, in addition to the rivet strength required for the transmission of the direct strut pressure to the ½-in. gusset plate, the shear due to the bending moment $\frac{1}{12}WL$ inch-pounds has to be provided for. On account of the small arm of the force couple (the shear resistances of the rivets on opposite sides of the gusset plates, which have to balance the moment $\frac{1}{12}WL$), this shearing stress is very considerable.

The moment figured for the given example and a strut length of 96 in. given by Alex. W. Mosely in the first article of this subject is

$$\tfrac{1}{12}WL = \frac{70L \times A \times r}{c}$$

$$= \frac{70 \times 96 \times 9.0 \times 1.45}{3.75}$$

$$= 23{,}400 \text{ in. lb.}$$

and

$$\frac{23{,}400}{\frac{1}{2}(arm)} = 46{,}800 \text{ lb. shear on rivets}$$

requiring $\frac{46{,}800}{7220} = 6\frac{1}{2}$ rivets for this purpose.

Summing up:

Capacity of strut = 9.0 sq.in. × 11,100 = 99,900 lb.;

For bearing of one ⅞-in. rivet on ½-in. gusset plate, 10,500 lb.;

Number rivets required for direct pressure $\frac{99{,}900}{10{,}500}$ = 9.5;

Number rivets required for end bending moment = 6.5;

Total number of rivets, 16.

A uniform load of w pounds per inch has been assumed to cause the stress $70\frac{L}{r}$ lb. in the extreme fibers, rather than a concentrated load in the center, because the uniform load gives the greater V and the smaller p. For a concentrated load in the center the V would be only ½ and the pitch ½ of the respective values found for the uniform load.

The writer does not wish to be understood that no other lateral load or loading system causing the fiber stress $70\frac{L}{r}$ lb. would give a greater shear than the uniform load, but has used the uniform load as the more plausible assumption.

P. J. MARKMANN.
St. Louis, Mo.

Compares Automobile and Team Costs

Comparing the cost per mile of the automobile with a team for the use of the project and irrigation managers of the Belle Fourche project, B. E. Hayden, in the July number of the *Reclamation Record*, finds the first cost of smaller machines considerably less than the cost of a good team, buggy and harness, and the operating cost about one-half as much. The efficiency, in point of time, however, is twice as great. A team will travel about 6 miles per hour against 15 miles for the machines. In traveling 15,600 miles in five years, assumed to be the life of a team, there is a saving of 195 eight-hour days.

Some of the costs of operating these machines on the Belle Fourche project are as follows:

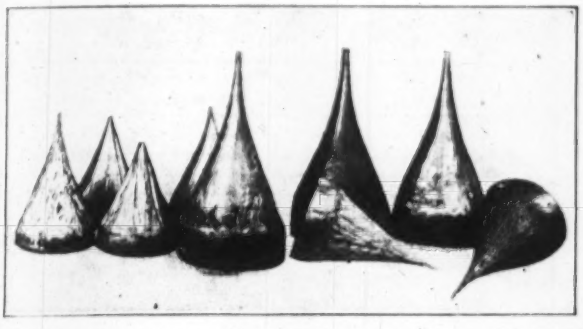
Unit	No. 1	No. 2	No. 3
Horsepower	30	20	20
Passengers	5	5	5
Date purchased	June 13, 1911	Aug. 21, 1915	Nov. 11, 1916
Cost f.o.b. Newell, S. Dak.	$1,200	$502 26	$405
Present condition	Sold Dec. 16, 1916	Good	Excellent
Miles operated	15,900	8,593	350
Cost per mile, including depreciation	$0.157	$0.080	$0.066
Miles per gallon of gasoline	10	15	17
Miles per gallon of lubricating oil	191	192	.....

THE ENGINEER IN FIELD AND OFFICE

A DEPARTMENT DEVOTED TO DETAILS OF THE DAY'S WORK

Alaska's Glacial Silt Rapidly Erodes Needle Tips of Waterwheels

EROSIVE action of suspended glacial silt on waterwheel parts is strikingly illustrated in a photograph recently made by Hugh Currin, chief operator of the Nugget Creek plant of the Alaska Treadwell mine. The plant consists of two units, one a single overhung Pelton unit rated at 1900 hp., the other a double overhung Pelton unit rated at 3800 hp. Each runner is equipped with two nozzles. Both units operate under a head of 490 ft. and are fitted with water-economizing relief nozzles.



NEEDLE TIPS SUBJECTED TO GLACIAL SILT LAST ONLY A FEW YEARS

Nugget Creek has its source in a glacier, which for a large part of the year discharges large quantities of silt into the stream. This silt varies in size from fine glacial flour to ordinary quartz sand; all is highly abrasive.

The large tip in the center of the illustration was in the relief nozzle of the single runner unit. It had been in service for four years when replaced. Before it could be removed from the stem, it was necessary to drill the holes shown near the base. The other two large tips from the relief nozzle of the double overhung unit, after three years' service, were removed by the tip spanner without difficulty.

The four small tips in front were in service for four years before replacement. With the exception of the one on the left, which required starting by a cold chisel, as shown by the scoring near the base, each of these was readily removed by the spanner. The two small tips in the rear were in service under extreme silt conditions, even for Nugget Creek, for one year before replacement.

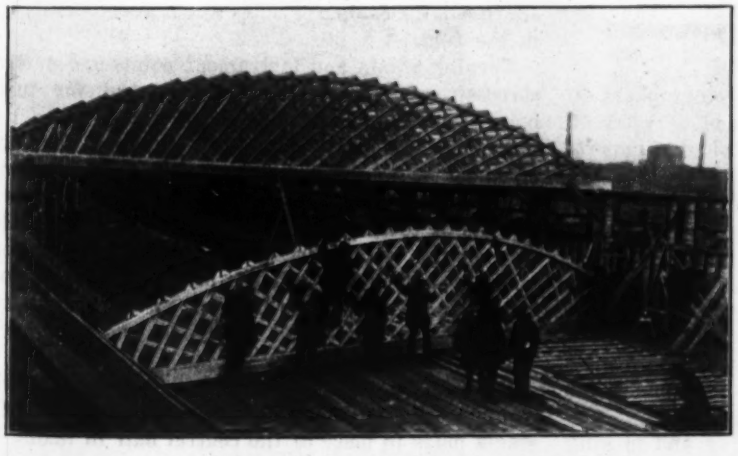
Lantern Slides Should Be Carefully Indexed and Filed

BY RUTH CANAVAN
Librarian, Metcalf & Eddy, Boston

PERHAPS the most customary method of filing lantern slides is in the wooden boxes which are on the market for that purpose. These are of varying capacities, containing from 50 to 200 slides. Each slide has its individual compartment formed by cardboard partitions inserted in grooves in the sides of the box. When the hinged cover is raised the rim of the long way of the box is seen to be divided off by the indentations made by the grooves. Each division marks a slide compartment, and it is convenient to number these divisions on the front rim with small india ink figures to correspond with the numbers of the slides. On either end of the exterior of the box the inclusive numbers should be indicated. As the slides are numbered in the order of their accession no duplication occurs, and the boxes may be arranged uniformly and neatly in numerical sequence.

Each slide when received is numbered in india ink upon the thumbspot. An indelible ink is especially necessary for this since the thumbspot marks the position

Canadian Camp Roof Trusses Easily Built



ON SEVERAL buildings now being erected in the Canadian Military Camp, long span roofs were demanded by the specifications. Bate & McMahon, contractors, of Ottawa, have originated and perfected a design which is economical of material, uses small-size sticks and is easily handled. One of the interesting features is the extension of the diagonal ribs beyond the upper chord —thus forming slots, as shown in the illustration, between which the purlins fit and are securely held. On these purlins the roof sheathing is laid in the direction of the span.

for the operator's thumb when he inserts the slide in the lantern, and ordinary ink would smut. Close beside the thumbspot there should be another small sticker which is left blank so that those slides selected for a lecture may be lightly numbered in pencil to insure their temporary sequence. On a narrow strip pasted across one end of the slide the brief title should be written.

To avoid misplaced slides they should be arranged so that they face the left-hand end of the box and have the thumbspots at the top, thus facilitating ready detection of any discrepancy between a slide number and that of its compartment. Similarly, in the traveling case, this arrangement is a convenience since it enables the operator to seize the slide with its face toward him and by a turn of the wrist to invert it in readiness for insertion in the lantern.

Slides Should Be Carefully Indexed as They Are Received

As received the slides are listed under the headings Slide Number, Title, Owner, Date and Origin, on letter-size sheets secured between cardboard covers by brass binding pins. Following this accession list and separated from it by a colored sheet is the place or subject list. To each place of which there are descriptive slides a page is devoted upon which the numbers and titles are listed. For theoretical features, diagrams, tabulations, etc., a sheet headed Miscellaneous is provided, from which, however, any of the items may be segregated upon separate subject sheets when desirable. These place and subject sheets are assembled in alphabetical sequence.

A heavy manila envelope, say 9 x 5 in., pasted on the inside of the back cover, affords an opportunity for the filing of lists of slides temporarily withdrawn from the file. While these lists may be mere memoranda to be destroyed when the slides have been checked off as returned, it is preferable to typewrite them in permanent form upon sheets headed with the name of the borrower, the title of the talk, the place, date, etc.—since such lists have a suggestive value in the preparation of further illustrated talks. Before the slides are returned to their compartments the pencil numbers added by the borrower should be transferred to the loan list, to show the sequence in which the slides were used, and then erased from the slides.

Photographs Taken by City Departments Are Better and Cheaper

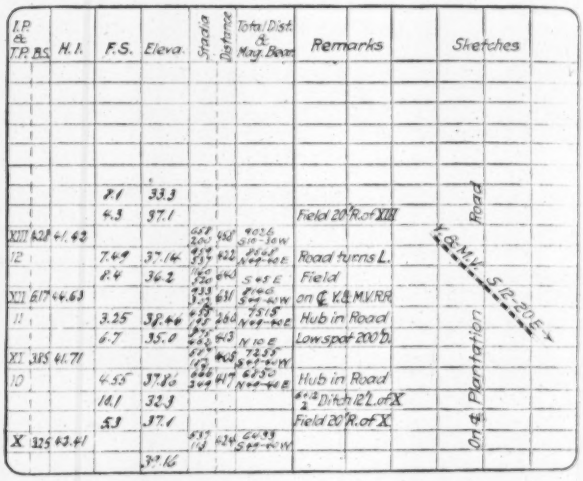
Owing to the fact that commercial photographers do not fully appreciate the engineering side of work of which they may be called upon to take a picture, important points are not brought out so clearly as they are when the work is done by an employee of the department, if he be provided with proper equipment, according to the annual report of Roscoe N. Clark, City Engineer of Hartford, Conn. Furthermore, it often proves difficult to get a photographer to take pictures upon short notice; and, as is often necessary, the man hired for the work does not look with favor upon the prospect of descending a shaft and entering a wet tunnel, for instance, with his own expensive outfit.

The value of photographs in accenting and making clear a verbal or even written description has been proved over and over. The difference in cost between pictures taken by the department and the cost of the work done through professional photographers is decidedly in favor of the former, since by doing its own work, the only cost that the department finds it necessary to carry is the cost of the materials—plus, of course, the time of the man who has to be taken from his regular work to make pictures.

Value of Stadia Surveys Increased by Carefully Kept Field Notes

By A. M. Shaw
Consulting Engineer, New Orleans, La.

IT IS especially important that some definite form of note-keeping be followed in making stadia surveys, even if they are to be platted by the one who makes the survey. There are so many classes of information to be recorded, that if the work is not done systematically, the value of the data recorded is lost through the impossibility of transferring the information contained in the notes to a scale map. This form must, of necessity, be adapted to the work to be done, and should, so far as practicable, conform to established forms of note-keeping. The form used by the writer in making drainage reconnaissance surveys is illustrated by the accompanying sample of notes which were recently taken in the field.



SYSTEMATIC NOTE-KEEPING HELPED BY THIS FORM

Turning points and instrument points are numbered successively—arabic figures being used for turning points, as they are usually placed on the stake by an untrained assistant, and Roman numerals for the instrument points. The turning points are available for later cross-line surveys. All instrument heights and heights of turning points are calculated in the field as well as the stadia distance. A mental calculation is made by adding one-half the observed distance to the lower stadia reading as a check on the level reading on the central cross-head. This also serves as a check on the observed distance.

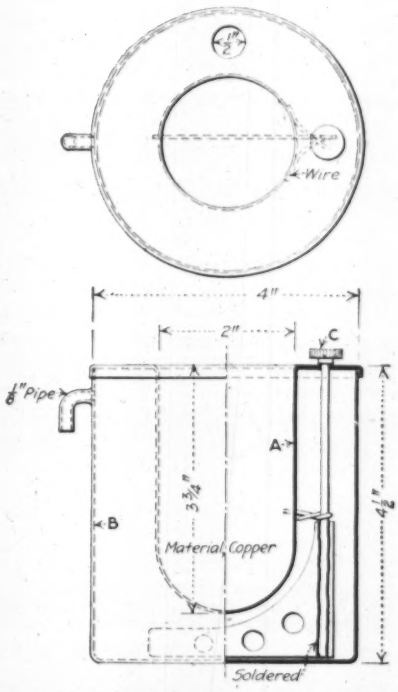
Stadia hairs on a level are always open to objection, owing to the danger of the observer using one of the stadia hairs in place of the central hair in taking level reading, but this danger is reduced as one becomes fa-

miliar with the instrument and is eliminated if the foregoing method of checking is followed. In the level used by the writer the focal point and the center of the instrument coincide, so that no constant is applied to stadia distances.

In line surveys the distance from starting point to each instrument point and turning point is computed and recorded in the distance column, this computation being done at night, or after return to the office. After being checked by adding the observed distance from starting point, the total distances are set down in ink, and are of assistance in platting the survey.

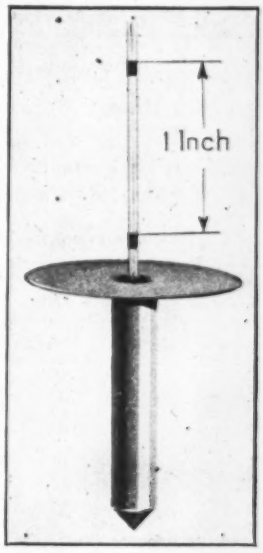
Design Simple Tester for Gaps Between Viscosimeter and Penetrometer

THERE has always been some question as to the value of using the viscosimeter for determining the consistency of road oils when the test has to be made at a temperature much above 100° F. Generally, also, there are many petroleum and tar products which offer so little resistance to penetration at the standard temperature of 77° F. that the necessarily short test period makes the error of determination excessive.



COMBINED BITUMEN CONTAINER AND WATER BATH IS OF SIMPLE CONSTRUCTION

Both Lunge and Hutchinson have designed and used tar testers with considerable success, and in the transactions of the American Society for Testing Materials of about ten years ago Allan W. Dow describes a modification of the penetration needle which consisted of, in effect, a plunger fitting with varying degrees of closeness into a cylinder which contained the material to be tested. To all of these instruments Prevost Hubbard and F. P. Pritchard, of the Office of Public Roads and Rural Engineering, found exception. After a good deal of experimentation and minor changes in design, they finally designed the apparatus shown in the accompanying illustration, which in their opinion, expressed in a paper before the recent convention of the American Society for Testing Materials, will give indications of practical and relative value on petroleum and tar products in the critical range outlined above.



TIME REQUIRED TO SINK ONE INCH IS MEASURE OF CONSISTENCY

The apparatus itself, weighing 2.8 grams and having a specific gravity of 2.13, is extremely easy to handle and clean—being only 3 in. long. It is made entirely of aluminum and brought to correct weight by means of fine shot. Two 0.14-in. holes are placed diametrally, in the disk, close up against the larger cylinder. A special bitumen container is used with this instrument. The details of its construction are shown in the drawing. The inner compartment is filled with the material to be tested, and after it has been cleared of all air bubbles, the instrument is allowed to sink of its own weight from the lower mark to the upper mark—a distance of 1 in.—and the time required is noted and serves as a measure of the consistency of the material.

Attention to Small Details Facilitates Street-Improvement Surveys

By M. Y. Crowdus
Assistant City Engineer of Nashville, Tenn.

GOOD equipment for a municipal engineering corps should comprise (1) a self-reading rod for setting grade points; (2) a small hand ax and a small cold chisel for marking grade points on curbs; (3) a spool of Cuttyhunk fish line; (4) a 10-lb. sledge hammer, an 18-in., 2 x 2-in. square-pointed steel bar for setting stakes, and an 18-in. key-hole saw with detachable handle for use when the stakes cannot be driven with heads to grade; (5) a sifter-top tooth-powder box for holding tacks; (6) a hand level—a great time saver on turning points, preventing errors of judgment in setting up the level too high; (7) a pocket indicator or counter for registering loads of material, stationing, etc.

In using a wye level, to relieve eye-strain, remove the screw cap of the objective end of the eyepiece. The field is greatly enlarged, and quicker sights are possible. Never neglect, however, to replace the cap, for a broken lens is a broken lens.

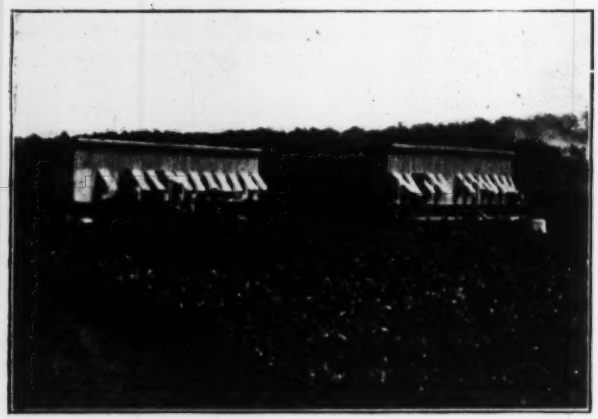
In giving pavement grades, mark the spring line of the crown of the pavement on the curb at each break in grade. Then with a tight line stretched from the head of the street-car rail to the gutter grade, the inspector or foreman can restore any grade points that may be lost. This is a help when conduit manholes have to be reset at points opposite breaks, where a stake could not be driven on account of the manholes.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Contractor Develops Economical Camp Building, Two Men to a Room

A TYPE of camp building which is unglazed and which provides a locked room with two single cot beds for every two men has been developed during the past few years by the Fred T. Ley Co., Inc., and is a feature of its construction camp at the Ayer cantonment. The rooms are 8 ft. square and are arranged in buildings two rooms wide and thirteen rooms long, or



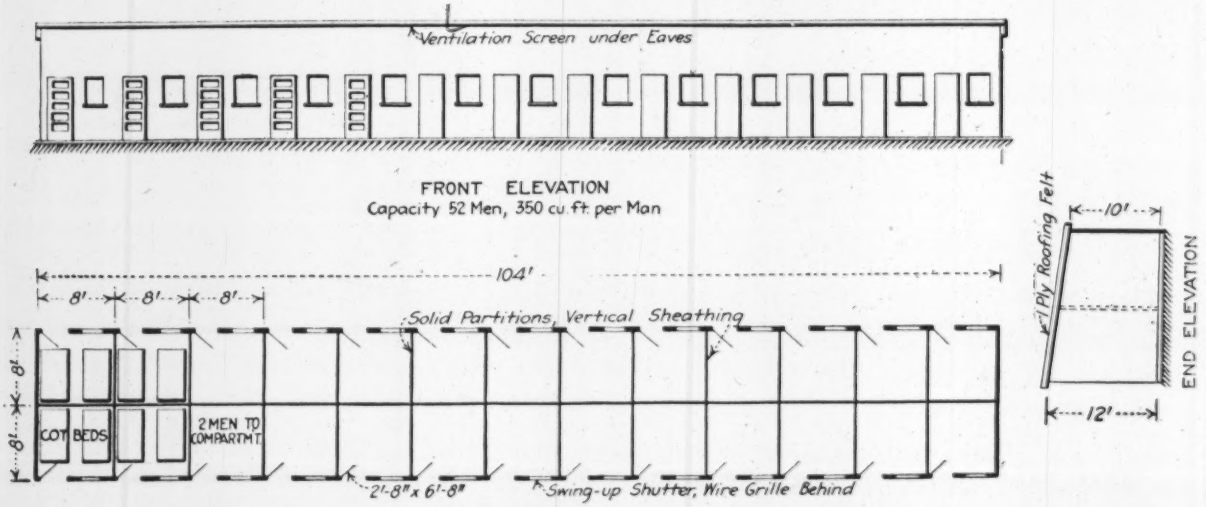
WITH TWO-STORY BUNKS IN CONTRACTOR'S CAMP
BUNKHOUSES HAVE NO GLAZING

16 x 104 ft. Each room has a door and a window. The door is an ordinary solid affair, but the window in place of sash is provided with a swing-up shutter, which leaves the opening unguarded when raised, except for a chicken-wire screen. Ordinary fly-screen wire is substituted for the chicken wire in locations where flies or mosquitoes occur. Each building has a sloping roof, pitched 2 ft. in 16, with a ventilating screen under the eaves at each side. The interior partitions are only 9 ft. high, being carried up to the roof with chicken wire. With this arrangement the ventilation is equal to, or better than, that in an ordinary bunkhouse, while the men are not easily able to climb around into each other's rooms. While, of course, an expert cracksman would find no difficulty in burglarizing such a bunkhouse when no one was around, it is believed that personal belongings and tools are safer in them than in the average contractor's camp. The cost per man is said to figure very low.

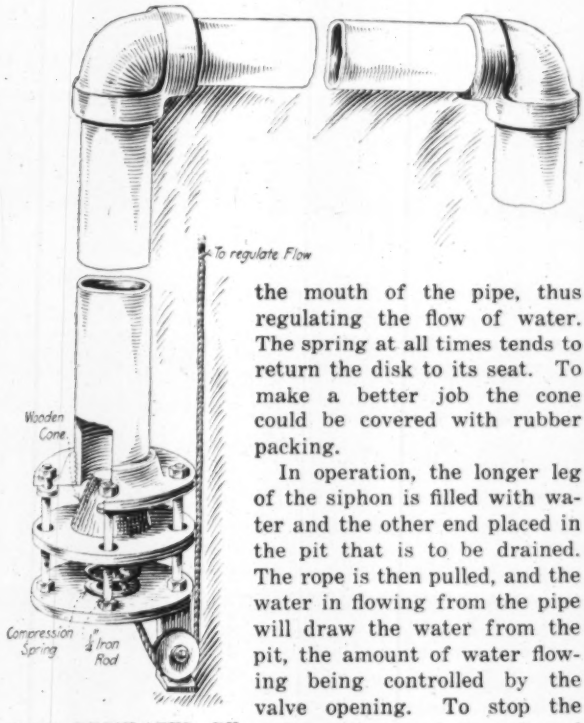
Simple Valve Avoids Necessity of Priming Siphon Continually

THE objection is sometimes raised to the use of a siphon in draining pits, that it is difficult to regulate the flow so that when the pit is entirely drained the pipe will draw air, necessitating priming it again, and this continual priming might involve more labor than the direct use of a pump. Regulation of the flow of a siphon to any degree up to the capacity of the pipe can be secured by use of a valve made as described by J. M. Purcell in a recent issue of *Power*.

The essential parts are shown in the illustration and consist of three flanges fitted to the discharge end of the siphon pipe, four rods, a compression spring, a cone-shaped piece of wood and a piece of rope. One flange is screwed to the end of the siphon pipe and connected to a second flange, by the four rods equally spaced. The cone-shaped piece of wood, which acts as the disk of a valve, seats on the third flange, which is guided by the four rods and forced to its seat by the spring. The rope can be attached to the lower end of the wooden cone and is used to pull the disk away from



COT BEDS AND TWO-MAN ROOMS REPLACE OPEN FLOOR



FLOW REGULATED BY ROPE

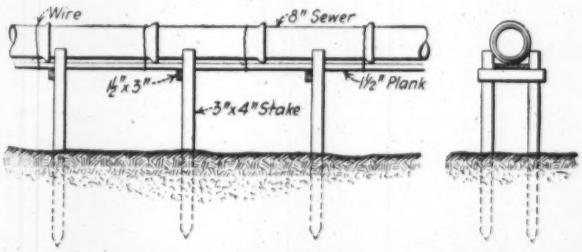
the mouth of the pipe, thus regulating the flow of water. The spring at all times tends to return the disk to its seat. To make a better job the cone could be covered with rubber packing.

In operation, the longer leg of the siphon is filled with water and the other end placed in the pit that is to be drained. The rope is then pulled, and the water in flowing from the pipe will draw the water from the pit, the amount of water flowing being controlled by the valve opening. To stop the siphon, the rope is released allowing the disk to return to its seat, thus entrapping the water in the long leg, until it is desired to start the siphon again. This is preferable to the common practice of throttling the intake.

Sewer Pipe at Dam Laid on Elevated Plank Before Fill Is Made

By G. W. McAlpin
Florence, Ind.

TO SAVE future excavation, sewer pipe, as shown in the accompanying sketch, has been laid before fill was made at Ohio River dam 39. A trench dug for



THIS TRESTLE FOR SEWER PIPE SAVES FUTURE EXCAVATION

the sewer pipe after the fill had been made would have had to be sheeted, as the material was fine sand and gravel. Hence it was decided to lay the sewers first, if possible, and fill around them.

Crosspieces, at the proper grade, nailed firmly to stakes driven into the original ground, supported a 1½-in. plank, upon which the pipe was laid. The supports were spaced about 3 ft. center to center, thus preventing the plank from sagging with the weight of the pipe. The pipe was wired to the plank to further hold it in position. When fill was placed, it was carefully tamped under and around the pipe and plank.

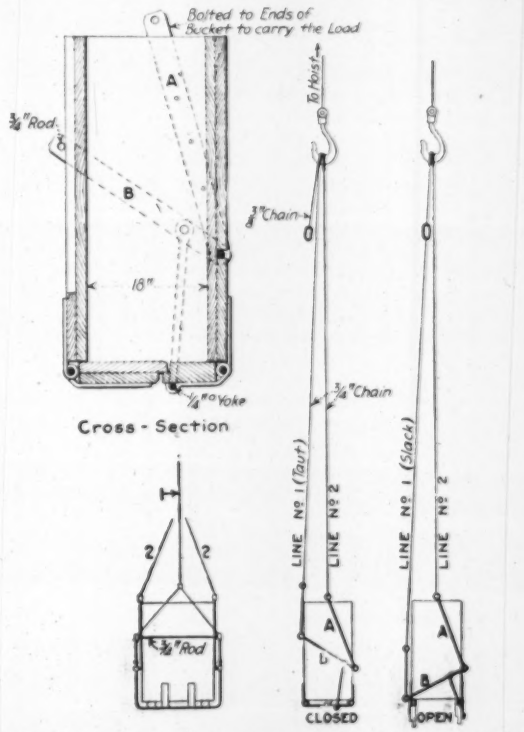
This method will allow the fill time to settle before taking the weight of the pipe, which of course it may do eventually if the plank rots.

Makes Bottom-Dump Bucket for Under-Water Concrete on Job

By E. S. Needham
Livingston, Mont.

IN THE construction of the Ozama River bridge at Santo Domingo, the remoteness of the site and the unsettled political conditions made it most difficult to obtain equipment, so the contractor had to resort to a good deal of improvisation. Among the many pieces of equipment made up on the job from the material at hand was a bottom-dump bucket for placing under-water concrete.

It may be seen from the accompanying drawing that the details are rough, though adequate in strength. Constructed of candelon, a native hardwood, it was 18 x 30 in. in plan and about 40 in. deep. The action



ENGINEER ON SANTO DOMINGO WORK MAKES HIS OWN BOTTOM-DUMP BUCKET

of the bucket is clearly seen, but is best explained briefly by saying that, while the tension was upon it, line No. 1 held the bottom shut through the toggle lever. After the bucket had reached position, the main line to the hoist was slacked sufficiently to allow line No. 1 to be lifted from the crane hook and let out about 2 or 3 ft. This released the bottom doors; and the bucket would be raised entirely by line No. 2—and the bottom door, thus released to the slack in line No. 1, would open and deposit the concrete at the point desired.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Bayonne's Proposed Terminal Killed by Voters

Planned on Lines of Bush Terminal, It Combined Warehouses and Piers

The project for Bayonne, N. J., to issue $10,000,000 bonds for a terminal port and warehouse scheme was defeated on July 31 by a vote of 3408 to 1075. The proposed terminal, which had been worked out in considerable elaboration by B. F. Gresson, was planned on the lines of the well-known Bush Terminal in Brooklyn; that is, it was to have combined warehouses with terminal piers which were to be used not only for ocean transfer but for local transfer in New York harbor. The vote was upon a plan whereby the Bush Terminal Co. was to lease the terminal for 50 years.

Bridgeport May Have City Manager

The adoption of a commission-manager charter will be voted on at Bridgeport, Conn., Aug. 11. If the proposed charter carries, the city will have a manager who will appoint all city officials subject to appointment, except only the city clerk and the corporation counsel. The charter provides for five commissioners, elected by preferential ballot. The Civil Service Commission will have jurisdiction over the selection of appointees in all the departments. A proposed commission-government charter received a heavy majority of the votes cast in November, 1916, but it lacked the statutory requirement of 60% of all those voting.

Concrete-Mixer Wins Suit

A decree signed by Judge F. A. Geiger, of the District Court for the Eastern District of Wisconsin, sustained as valid patents owned by the Koehring Machine Co. in its suit for infringement and injunction against the Oshkosh Manufacturing Co. The decree awarded an accounting of damages and profits sustained by the plaintiff.

The above suit involved an adjudication of the patents controlled by the Koehring Machine Co. directed to what is known as the reversible mixing and discharge chute feature and also patents of the same company covering the boom and bucket distributing attachment for mixing machines.

The expert used by the plaintiff Koehring Machine Co. at the trial was Nathan C. Johnson, consulting concrete engineer of New York, whose articles on "Material versus Methods," "Testimony of Moving Pictures and the Study of Concrete" appeared in the *Engineering Record*, Dec. 4, 11 and 18, 1915. The moving pictures used by Mr. Johnson in his studies and referred to in the articles were exhibited to the court at the trial of this cause and formed part of the evidence on which Judge Geiger based his decision.

Cleveland Employs Coal Expert

After a search of several weeks for a coal expert, W. E. Davis, commissioner of light and heat, Cleveland, has arranged with Prof. H. E. Nolds of the Ohio State University to study and report on the several propositions under consideration in connection with the city's intention to buy its coal at the mine.

Type of New Ore Docks on the Great Lakes

DOCK NO. 5 OF THE DULUTH, MISSABE & NORTHERN RY., AT DULUTH, MINN. THIS DOCK IS 2304 FT. LONG AND HAS 384 POCKETS OF 300 TONS' CAPACITY EACH—OR 115,200 TONS' TOTAL CAPACITY. HEIGHT FROM WATER TO RAILS, 80 FEET 6 INCHES. WIDTH OF DECK, 56 FEET

Illinois Wants Engineers for Water-Works Valuation

Civil Service Commission To Hold Examinations—Applications Before August 23

The Illinois State Civil Service Commission will hold an unassembled examination to provide an eligible list for the position of mechanical engineer for the Illinois Public Utilities Commission. There is one position to be filled now at Springfield. The position is open to nonresidents of Illinois and is open to male citizens of the United States over 25 years old. The salary ranges from $160 to $250 a month. The duties of the position involve charge of investigation of water-works and steam-heating properties with regard to valuations for rate-making proceedings and special operating problems and preparations of orders in water-rate cases. In general, the examination will consist of the following subjects weighted as indicated: Training and experience, 4; special subjects covering the above-mentioned duties, 6; total, 10.

It is expected that applicants will have general familiarity with the Illinois Public Utilities Commission law and the equivalent to graduation in mechanical engineering from an engineering college of recognized standing, together with experience in the operation, construction and design of mechanical equipment with particular reference to water-works property; ability to make valuation of such property and compute satisfactory ratings is also desired. It will not be necessary for candidates to come to Illinois unless notified to do so. Applications must be on file at Springfield before 5 p.m., Thursday, Aug. 23, 1917. No application blanks will be mailed after Monday, Aug. 20, 1917. Application blanks may be secured by addressing the Illinois State Civil Service Commission at Springfield.

Port Authorities Will Meet at Portland

The Pacific Coast Association of Port Authorities will hold its annual meeting at Portland, Ore., Sept. 4, 5 and 6. There will be delegates in attendance from the several ports along the Pacific Coast. Matters of mutual benefit to each section in a shipping way will be discussed. Last year the session was held at Vancouver, B. C. Charles B. Moores, Portland, chairman of the Commission of Public Docks, is president and G. B. Hegardt, engineer for the Portland Commission, is secretary.

Investigate Austin Dam To Palliate Citizens

Engineer To Determine What Receiver Should Do To Make Structure Comply with Specifications

EDITORIAL CORRESPONDENCE

The City of Austin, Tex., has employed Daniel W. Mead, of Madison, Wis., to investigate the Austin dam as constructed and make recommendations as to what should be done to complete it properly. The city claims that the specifications were not complied with, and so far has refused to pay for the construction. It was partly in compliance with the wishes of the receiver of the construction company and partly to palliate the citizens who were clamoring for the completion of the dam that Mr. Mead was engaged to determine what the receiver should do in order to make the dam comply with the specifications and be acceptable to the city. Mr. Mead is expected to begin his investigation about Aug. 1. He is to receive a retainer fee of $1000 and $100 per day and expenses during the time he is engaged on the investigation and report.

Laguna Dam To Irrigate 200,000 Additional Arid Acres

By a contract just executed between the Secretary of the Interior and the Imperial Laguna Canal Co., of southern California, a tract of arid land comprising from 120,000 to 200,000 acres adjoining the Imperial Valley is to be irrigated by means of an all-American canal some 30 miles in length. The water is to be taken from the Laguna dam of the Yuma reclamation project on the Colorado River at Yuma, Arizona.

JOINT SURVEY WILL BE MADE

Before the proposed system is authorized to be constructed by the Department of the Interior, there is to be a joint survey and examination of the proposed route of the canal by an engineer of the Government, an engineer for the Imperial Laguna Canal Co. and a representative of the State of California. The land which is to be irrigated is contiguous to the present irrigated area in the Imperial Valley and was withdrawn from entry some years ago under the Reclamation Act for reclamation purposes. The contract just executed provides for the release of the lands at the proper time in such a manner as to make them part of the project and irrigable thereunder in 160-acre tracts.

The Government is to build the connection with the Laguna dam and the enlargement of the Government canal at the expense of the Imperial Laguna Canal Co., or to have the privilege of supervising the construction. The corporation is to pay its proportionate share of the cost of operating and maintaining the Laguna dam and appurtenant structures. Under the terms of the contract the company concedes the prior right of the United States Government to all water necessary for the Yuma project, now in operation, or which may be built and put in operation within the next 10 years.

The contract has been so drawn as to protect the interests of the public and to insure the feasibility of the project before connection with the Government dam is permitted, and before any money derived from the sale of stock is made available to the corporation. It is expected that the completion of the canal will largely enhance the productivity of California lands along the Mexican boundary.

New York City Traffic Commission Authorized

A Traffic Commission, to consider the entire problem of traffic congestion and the most efficient plan for future development of the thoroughfares of New York City, has been authorized by the Board of Estimate. The members of the commission will serve without pay, and no positions will be created or appropriations made for the work of the commission. Nelson P. Lewis, chief engineer of the Board of Estimate, and the engineers of the various boroughs will make the necessary engineering investigation and report. Robert H. Whitten, secretary of the Committee on City Plan, will serve also as secretary of the commission. The commission will consider traffic regulation and other means of increasing the capacity of existing streets; grade separation at important intersections, together with street widenings and new streets, and a complete system of automobile and trucking thoroughfares for the five boroughs in order to link them and the whole city with neighboring centers in both New York and New Jersey.

Steel Market Typifies Trade Conditions in Construction Materials

Buying Stagnation Will Persist Until There Is a General Readjustment of Prices on Lower Basis

New influences developed during the month added to the halting tendency caused by abnormally high prices and excess of orders for nearly all materials. The unfortunate effect of the general conditions strongly seconded by the increasing railway congestion is to check the activity in those lines where prices remained nearer normal. The fact is, probably, that the fundamental uncertainty as to Washington's price-regulating moves exerts even a greater influence than would be supposed.

The steel market is typical of the situation. As regards new buying it has been absolutely stagnant since early in July. A common view in the steel trade is that the stagnation dates from the publication on July 12 of President Wilson's appeal to mine owners and manufacturers, that they should "forego unusual profits" and that there should be "one price for all," that is, for the Government, for its Allies, and for the ordinary domestic buyer. The words of the President have had an important effect upon the market, quite out of relation to his power, as at present he has authority to fix prices only on material purchased in connection with prosecuting the war. He spoke at a moment when buyers tended to halt altogether, after having become decidedly more reserved in the matter of making commitments for far forward deliveries. During May and June the open market buying was confined very largely to relatively early deliveries.

VERY LITTLE NEW CONTRACT TONNAGE

In the matter of specifications against contracts entered into some time ago, and of course at prices much below those lately ruling as the open market, there was a slight decrease noted as early as the first fortnight of June, and there were further decreases in July. Of new contract tonnage, as already indicated, there has been very little. The Steel Corporation's unfilled obligations decreased by 500,000 tons in June and are predicted to decrease by perhaps 750,000 tons in July, although there has been considerable tonnage entered for Government account. The Corporation's shipments average about 1,300,000 tons a month.

That the pig-iron and finished-steel markets will remain stagnant, or at least that there will be no general buying movement, until there has been a general readjustment of prices on a lower basis, is now a universally accepted conclusion. At such a juncture producers endeavor to hold prices as long as possible, in order to encourage specifying on existing contracts, for once the market declines below the contract level buyers seek to cancel, or withhold specifications, except in such cases as provide specifically that the contract is firm and not subject to revision. From this viewpoint a period of several months, probably more than three, would elapse before there would be any disposition for open market prices to decline.

LOWER COKE WILL AFFECT PRICE OF PIG

If the proviso in the Senate food control bill, that the President is empowered to fix prices on coke, remains in the bill as finally approved, and the President exercises the power, a readjustment in the price structure may be started at an earlier time. In the past two months Connellsville furnace coke has been at an extremely high price, and a large reduction would decrease the cost of making pig iron and would

exercise a sentimental influence besides, so that furnaces would probably see the necessity of reducing pig-iron prices, and steel prices would naturally begin to yield also.

Predictions of a scarcity of steel in general, such as that recently made by the United States Chamber of Commerce, a prediction that was severely criticized in the steel trade, lose sight of the vital fact that the steel rolling industry is highly specialized. The industry is producing at the rate of 43,000,000 or 44,000,000 gross tons of steel ingots a year, but it is impossible greatly to increase the output of one form of rolled steel at the expense of another. The plate rolling capacity will be strained to the limit, to meet shipbuilding requirements, but the greatest tonnage of structural shapes that can be used in shipbuilding will still leave much shape rolling capacity. Government requirements in pipe, for all war purposes, cannot be large in future, now that the deliveries on the Mesopotamian pipe line, nearly 300 miles, are about completed. For ordinary sizes of merchant steel bars, and for bars rolled from old rails, used largely for concrete reinforcement, there cannot be any particularly heavy Government demand. The railroads, however, are taking up few old rails as the mills have been accepting only limited tonnages in new rail orders. Mills in a position to supply light or rerolled rails can get premiums of $5 to $10 per ton over normal prices.

STAGNANT CONDITION IS COUNTRY-WIDE AND IN ALL LINES

As indicated above, steel just now typifies conditions in the other materials markets. The price of sewer pipe has advanced only in Dallas and New Orleans; in Denver there was a decided drop. Practically the same condition obtains in the case of clay drain tile and the concrete materials, even though sand, gravel and crushed stone are largely a local proposition. Common brick is stagnant, owing to diminished building and consequently small demand. Other construction materials, such as hollow tile and roofing, show no action. Lumber is variable, as might be expected. The drain due to cantonment and other camp work has not yet been overcome, railroad conditions are almost impossible, and at most points prices stop many normal lumber users.

Secretary of the Interior Lets Irrigation Contract

The Reclamation Service has been authorized by the Secretary of the Interior to award a contract to J. E. Hilton, of Lingle, Wyo., for the earthwork on the Fort Laramie Canal, Fort Laramie unit, North Platte irrigation project, Nebraska. The work involves approximately 336,500 cu.yd. of excavation and is located near Torrington, Wyo. The contract price is $53,410.

Taking Bids on $1,000,000 Road Improvements

EDITORIAL CORRESPONDENCE

The Oregon State Highway Commission has awarded or is calling for bids upon a large amount of roadwork. On July 20, bids were opened upon about 40 miles of paving. On July 31, bids will be received upon about 250,000 yd. of grading work, largely heavy rock. Altogether, the work started or authorized by the commission amounts to at least $1,000,000. Just how this is to be financed is a question, as none of the bonds authorized in June have been sold, and the available funds from other sources are entirely inadequate. It seems likely that the commission will ask contractors to take their pay in bonds.

The commission has recently made a decree that a 10-year guarantee will be required upon all paving work. Since the bonding companies will only issue corporate surety bonds upon pavements for a term of five years, the remaining five years will be covered by a personal bond.

The requirement of a 10-year guarantee is plausible, but is liable to lead to serious abuses and tends to limit competition upon paving work. The form of guarantee used in the past in Oregon has been so loose that unscrupulous contractors could escape, while reputable contractors would refuse to bind themselves with the opportunity of escaping on technicalities.

Venezuela Is Using American Construction Materials

Venezuela is now relying largely upon American manufacturers for her supplies of construction machinery and materials, but a report made public Aug. 1 by the Bureau of Foreign and Domestic Commerce, Department of Commerce, warns that effective measures will have to be taken to prevent much of this business going to Europe when the war is over.

Although construction work is not being carried forward with special energy at this time, says the bulletin, the field is worth the closest attention because there is certain to be a marked development in the future. A careful and judicious cultivation of the market is essential to the maintenance of the favorable position now enjoyed by the United States.

The report contains an illuminating discussion of the general industrial and commercial conditions in Venezuela and chapters on specific building activities, markets for all lines of construction materials and machinery, and the commercial practices and requirements of the country. "Markets for Construction Materials and Machinery in Venezuela," Special Agents Series No. 144, may be obtained for 10c. from the Superintendent of Documents, Washington, D. C., and from all branch offices of the Bureau of Foreign and Domestic Commerce.

Publicity Gets Engineers for Chicago Regiment

Needed Financial Backing Furnished by Business Men—Daily Papers and Movies Do Their Bit

The expansion of Company A, Engineers, Illinois National Guard, into a regiment has been under way for nearly a year, but it required a special drive in publicity, handled by an expert, to make any headway in recruiting in these days when so many other organizations and branches of the service are claiming the attention of the newspapers. A Citizens' Unit, composed of well-to-do business men, furnished the necessary financial and moral backing, but somehow the recruits were not forthcoming. E. H. Lee, vice president and chief engineer of the Chicago & Western Indiana R.R., was finally made chairman of a publicity committee. He enlisted the interest of the Universal Portland Cement Co., and the latter detailed J. H. Libberton, in charge of the promotion department, to the work.

SPECIAL DELIVERY RETURN ENVELOPE USED

The first drive was made on the daily papers. Each managing editor was addressed (by name) with a special-delivery letter, explaining the regiment and that it was distinctively a Chicago affair. Plans for a recruiting week were announced and suggestions invited. This was the "come back," and a special-delivery return envelope was inclosed for this purpose. Without exception the editors responded, and articles from a "stick" up to a column resulted. Twenty-two items appeared in two weeks. Plans for recruiting week were to include several startling features, among them the dropping of numbered pamphlets over the city by Ruth Law, the aviator. A reward of $50 was to go to the person who would bring in a predetermined number, or one nearest to it. These plans were abandoned because the navy subsequently decided upon a drive the same week.

MOVIES SHOW SLIDES

Two days after the editors were attacked, 125 moving-picture managers were sent special-delivery letters asking if they would show a slide for the engineers. As before, special-delivery returns were inclosed. This brought 100% results. A moving-picture scenario has been written by Mr. Libberton and pictures made by the Universal Weekly company. Types of men desired were shown in front of a recruiting station; also the awkward squad in training at the City Pier, a crack regiment, and work in the field. The weekly is shown in 150 theaters. In addition to these methods a committee was formed in every engineering organization to circularize the respective memberships and to push the propaganda at all meetings. Two weeks after the drive started, 700 of the 1070 desired men had been obtained.

Break in Los Angeles Aqueduct Near Neenac, Calif.

STEEL PIPE, WHICH WILL BRIDGE BREAK, IS SHOWN AT FAR SIDE

Building Show Next Year Instead of Usual Cement Show

The usual annual Cement Show at Chicago, which has been held for a number of years past, will not be given next year, but in its stead there will be a cement, machinery and building-materials show to be held in the Coliseum from Feb. 6 to Feb. 13, 1918. Practically the same rules which governed the ordinary Cement Show will govern the coming exhibition, with the exception that machines and products of interest to builders, even though they do not relate to concrete, will be permitted. The show is under the management of the National Exhibition Co., 123 West Madison St., Chicago.

Brick Against Segmental

The sewer-brick and segmental-block interests are having a tilt at Detroit. Heretofore the brick interests have controlled the field. The segmental-block people are now trying to get in. The Council Committee on Sewers started out on July 31 to inspect segmental-block construction in various cities. The Detroit Bureau of Governmental Research has submitted to Clarence W. Hubbell, city engineer, a proposition that bids be thrown open to brick, segmental block (vitrified clay and concrete), reinforced-concrete pipe and monolithic concrete.

Missouri Submits Federal-Aid Road Project Statements

The Missouri State Highway Department has just submitted to the federal department project statements for the improvement of 25 miles of macadam and gravel roads in Cole County, and 8 miles of concrete roadway in Jasper County. The Cole County project will cost $115,000, while the Jasper County project will cost $97,000. The Missouri department, operating under a new law, will supervise the building of more than fourteen million dollars worth of roads during the next four years.

Everglades Drainage District Gets Engineer

Supervisors of the Napoleon B. Broward drainage district, recently created by the Florida legislature, have engaged Isham Randolph & Co., of Chicago and Jacksonville, as chief and consulting engineers for the district drainage works, which are estimated to cost upward of $6,000,000. The district includes about 550,000 acres of land in the Florida Everglades, near Miami and Fort Lauderdale, and is to be reclaimed by a system of canals, dikes, ditches and roads. It is expected that the cost of reclamation will be from $10 to $15 an acre.

Bids were asked from engineers for taking charge of the plans and engineer work of the project, and the Randolph firm was low bidder. William A. O'Brien, who has been engineer in charge of the drainage of the half-million acre Girardeau district, in Missouri, has been employed by the district supervisors as project engineer.

Ogden, Utah, Paving Program Largest in Its History

Forty blocks of paving are on the program for this season, writes Joseph M. Tracy, city engineer of Ogden, Utah. "This is far above the amount done in any other previous year in the history of the city. Paving and sewers are the main municipal improvements. Sewer District 134, embracing one-half the area of the city, probably will not be under construction this year, but plans requiring from four to six months to complete are being made."

Board of Fire Underwriters Doing War Work

Besides General Fire-Protection Publicity Is Working on Cantonment Design

The National Board of Fire Underwriters since the beginning of the war has been particularly active in publicity work and other campaigning which would tend to reduce fire waste. This work consisted primarily in the organization of committees who, by means of public meetings and conferences with owners and with officials, aroused the communities to the need at present more than ever of safeguarding from fire all food repositories and similar structures.

Food Repositories Guarded

Each local advisory committee was furnished with a list of the various special agents in its territory and was requested to organize the field force therein for conservation work and to carry out any investigations and to secure any information which might be desired by any department of the Government or of the Council of National Defense. In practically all the states thus far organized special authority has been granted to the inspectors. In certain states where the law permits, the state fire marshal has deputized insurance inspectors as assistant fire marshals. In New York the State Council of Defense has a Bureau of Fire Prevention and has designated two of the engineers as directors thereof and has provided an office for the use of this bureau and an appropriation for clerical hire, etc.

Working on Cantonments

In addition to general informational service to the Government officials engaged in building the army cantonments two engineers were detailed for permanent service with the Committee on Emergency Construction and were assigned to the construction of waterworks and designing the systems of fire protection for all of the new cantonments and for other new structures which the Government is erecting. One of the board's engineers has been detailed to direct in person at each cantonment the layout of water mains, the organization of fire brigades and the installation of both temporary and permanent fire-protective apparatus.

Pioneer Paving Decision In Minnesota Court

If a recent decision in a lower court is sustained, Minnesota cities may award contracts for patented pavements even though their charters provide that all contracts must be let to the lowest responsible bidder. The decision was made by a judge in the District Court for St. Cloud, Minn., on application for an injunction against the award of a contract for bitulithic pavement. The judge said that there are decisions in other states both for

and against the plaintiff's claim, but that the precise question had never been decided in Minnesota. After weighing the decisions he concluded that the balance was in favor of permitting the award, which he felt was "the more reasonable position to take." Continuing, the judge said:

CONTRACT IS HELD VALID

"If it be good law that a city could not call for bids on a patented article, it would seriously interfere with the public comfort, safety and progress. The proper construction, it seems to me, to give to a charter provision of this kind is that a contract shall be let to the lowest responsible bidder where that is possible or practicable, and that in case of a patented article such a charter provision would not apply. In the instant case, however, it appears by the proof that the city before letting the contract did call for bids, not only for this kind of pavement, but for several other kinds, and after receiving all of such bids in the exercise of a sound discretion let a contract for bitulithic in preference to the others. It seems to me this contract is valid at least under the present showing, and that it would not be right for this court to interfere any longer in the progress of the work."

Another claim made by the plaintiff was that Warren Brothers Co. does not have a valid patent on bitulithic pavement and that, in the language of the opinion, "by specifying such pavement under such patent at the price of $1.45 [per yard?] to be paid said Warren Brothers Co." an unjust burden is placed on property owners and that the charge is unreasonable and unfair. This contention was disposed of by the familiar statement that the court could not consider a mere allegation of mistaken judgment on the part of administrative officers.

PERSONAL NOTES

ALEX. F. PROCTOR, Victoria, B. C., has been appointed acting chief engineer of the Provincial Department of Railways.

ANDREW T. HANSEN has been appointed city engineer of Los Angeles, Calif., to succeed Homer Hamlin, whose removal from the office was noted in these columns last week. Mr. Hansen was graduated from the University of California in 1903, and was then for three years assistant engineer in the United States Reclamation Service, spending the major portion of his time in the construction of the Yuma project. In 1906 he was made assistant engineer of the City of Los Angeles and was detailed to the outfall sewer as Mr. Hamlin's assistant, under whose personal direction this structure was completed. In 1908 he was made division engineer on the Los Angeles Aqueduct, and constructed the Jawbone division, one of the most inaccessible and heaviest divisions upon the aqueduct. Before the completion of this work Mr. Hansen was given, in addition to the Jawbone division, supervision over the Mojave and North and South Antelope divisions —an additional length of 76 miles. Upon completion of the aqueduct Mr. Hansen returned to the City Engineer's Department and assumed charge of the street work. In 1913 he was appointed chief deputy to the city engineer, serving in that capacity until his present appointment.

PROF. BORIS BAKHMETEFF, special ambassador from Russia to the United States, was recently elected a member of the Canadian Society of Civil Engineers.

O. LAURGAARD has been appointed city engineer of Portland, Ore., to fill the place left vacant by the resignation of PHILIP H. DATER.

FRANK A. FARLEY, formerly assistant engineer of the City of Cincinnati, has been appointed construction engineer of the Department of Public Works, State of Ohio.

C. E. HENDERSON has resigned as city engineer of St. Augustine, Fla., to take the position of county engineer of St. Johns County, of which St. Augustine is the county seat.

LAWRENCE H. DOOLITTLE, formerly with the American Smelting and Refining Co. at Perth Amboy, N. J., is now in the office of CHARLES A. TRIMMER, consulting engineer, Madison, South Dakota.

JAMES H. HOPKINS, who has been chief engineer on roadwork for Rhea County, Dickson County and Robertson County, Tennessee, has been appointed commonwealth engineer in charge of the construction of the "Midland trail" through Rowan and Carter Counties, Kentucky.

HARRY S. WRIGHT, CEDRIC H. COLLINS, ALBERT G. BARSTOW, RAYMOND H. BURTON, JAMES B. TURNER, FREDERICK L. DONEGAN, RALPH S. MOORE, JOHN H. KING, CARL FRANCIS and HARRY O. V. NORDQUIST have left the employment of the Water-Supply Board, Providence, R. I., to enter the Federal service.

W. H. WAUGH, formerly division engineer in charge of highway construction and maintenance, Bureau of Public Works, Manila, P. I., has been appointed senior highway engineer, Office of Public Roads and Rural Engineering, with headquarters at Juneau, Alaska.

CHARLES D. THOMAS, assistant engineer, Public Service Commission, First District, New York, has been commissioned captain in the Engineer Officers' Reserve Corps.

E. FRENCH CHASE, engineer, Streets and Sewer Department, Seattle, has been commissioned captain in the Reserve Engineers' Corps, United States Army.

THOMAS R. BEEMAN, deputy engineer, Kings County, Washington, has been commissioned captain in the Reserve Engineers' Corps, United States Army.

R. B. FREELAND, of Grand Forks, B. C., has been appointed provincial engineer for the government of British Columbia.

C. M. REPPERT, division engineer of design; JOHN D. STEVENSON, assistant engineer, Division of Design; NATHAN SCHEIN, assistant engineer, Division of Streets; and CHARLES F. BROWN, assistant engineer, Division of Surveys, all of the City of Pittsburgh, have joined the service of the Government in connection with the building of the cantonment at Annapolis Junction, Maryland.

MAJ. JOHN C. OSTRUP, who in May was assigned to the Plattsburg training camp, was recently transferred to the Engineer Officers' training camp at American University, Washington, D. C. Major Ostrup, who was connected with the Chicago and the Boston elevated railroads, and who later was called as professor of structural engineering at Stevens Institute of Technology, will maintain his office as consulting engineer at 17 Battery Place, New York City.

R. M. BOWMAN, who for the past four years has been assistant engineer of the Lake Erie & Western R.R. Co., with headquarters at Indianapolis, has been appointed highway bridge engineer in the Office of Public Roads and Rural Engineering with headquarters at Washington, District of Columbia.

C. E. PARIS, who has been business manager of the Imperial Irrigation District since November, 1916, tendered his resignation to the Board of Directors, effective Aug. 1. Previously to Mr. Paris' connection with the Imperial District, he was for eight years in charge of various engineering work in the same valley.

M. E. ALLEN, at present secretary and contracting engineer for the Central States Bridge Co., Indianapolis, Ind., has formed a partnership with R. W. BAILY, consulting engineer for steel structures and machinery, Chicago. The arrangement becomes effective Aug. 1 under the name of Baily & Allen Company.

L. G. HICKS, who for the past several years has been city engineer of Roseburg, Ore., has resigned to accept the position of district superintendent of construction for the Standard Oil Co., with headquarters at Seattle.

WESLEY PEASE, assistant engineer, and MARVIN PIERCE, assistant to City Engineer FRED O. EICHELBERGER, Dayton, Ohio, have tendered their resignations to become effective next week. Mr. Pease will become associated with the mili-

tary cantonment at Chillicothe, where he will be in charge of the engineering work. Mr. Pierce has accepted a position in connection with the construction of the Wright aviation field.

A. W. PHILLIPS, for the past year general superintendent of the Aetna Chemical Co.'s Canadian plant at Drummondville, Que., has resigned to accept the superintendency of the Synthetic Acetone plant of the Canadian Electro Products Co., at Shawinigan Falls, Que. R. A. LOCKERBY, who has been operating superintendent at Drummondville, succeeds Mr. Phillips. Mr. Phillips was formerly superintendent of the Aetna Explosives Co.'s guncotton plant at Gary, Indiana.

HENRY W. HODGE, whose commission as major in the Engineer Officers' Reserve Corps was noted in these columns two weeks ago, has resigned as a member of the Public Service Commission of the First District, New York State. During the year and a half that Mr. Hodge has served as

Resigns as Public Service Commissioner First District, New York

HENRY W. HODGE

Commissioner his engineering experience has been of much value in constructing the "dual" system of rapid transit for New York City. The firm of Boller, Hodge & Baird, of which he has been senior member since 1912, designed many of the largest bridges and buildings in the country, among them being the Duluth & Superior Bridge, the cantilevers across the Monongahela and Ohio rivers at Pittsburgh and Steubenville, Ohio, and the Municipal Bridge at St. Louis.

PROF. JOHN F. HAYFORD, director of the College of Engineering, Northwestern University, is at present in Washington serving as a member of the National Advisory Committee for Aëronautics, and is also temporarily on the staff of the Bureau of Standards in connection with the work of that bureau having to do with special problems of aëronautics.

PROF. JAMES M. BARKER, of the civil engineering department, Massachusetts Institute of Technology, has been retained as consulting bridge engineer by the Massachusetts Public Service Commission.

JOHN D. GALLOWAY has been appointed engineer in charge of the Northeastern Mineral Survey, covering the important districts in British Columbia.

CHAS. J. DECKMAN has resigned as president of the Medal Paving Brick Co., Cleveland, Ohio. Mr. Deckman has been connected with the paving-brick industry for the past 30 years.

ROBT. H. MURRAY, vice-president and manager of operations of the Chicago Bridge & Iron Works, has been given a commission as Captain of Engineers in the Officers Reserve Corps, and is now stationed at Fort Leavenworth, Kansas.

N. S. KLINK, formerly assistant engineer with the Aberthaw Construction Co., is now in the office of CHARLES T. MAIN, consulting engineer, Boston, Mass.

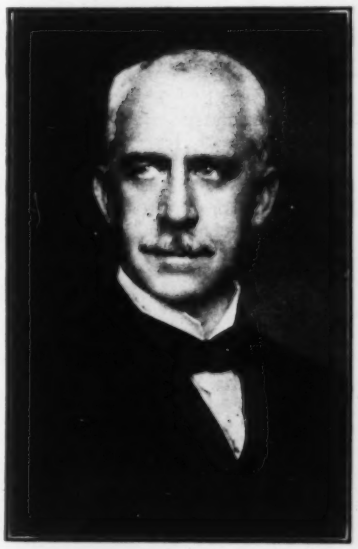
C. S. COE, engineer, maintenance-of-way, Florida East Coast Ry. Co., has been granted indefinite leave of absence for service with the Seventh Regiment of Railroad Engineers. The position occupied by him has been abolished, and L. T. FROHMAN has been appointed principal assistant engineer.

LLOYD T. MCAFEE, LEO GLICK, JOHN H. RYAN, EUGENE J. RIORDAN, RICHARD W. MONTELL, HENRY W. SWANITZ, EMIL F. MUHEIM, WILLIAM F. DONNELLY, JOSEPH E. CASEY, SAMUEL HODES and WILLIAM J. FITZGERALD were presented gold medals by M. M. O'SHAUGNESSY, city engineer of San Francisco, at the celebration of the completion of the Twin Peaks tunnel, July 14, as a token of appreciation of the assistance rendered to him in this work.

WILLIAM F. MOORE, city engineer of Grand Rapids, Mich., has been appointed state highway engineer of Indiana by the State Highway Commission. Mr. Moore has had experience in both the contracting and the engineering field. He was associated for a number of years with the firm of John Moore & Sons, contractors, but for the last 17 years has been engaged in engineering work. He was city engineer of Mishawaka, Ind., and then held the same position in South Bend for about 6 years. He has been city engineer of Grand Rapids for the past 2½ years.

GEORGE H. HARRIES, prominent as a public utility executive, has received a leave of absence from the various corporations with which he is connected in order to resume military service. He is now in command of the Nebraska National Guard, at Fort Crook, having been commissioned brigadier general by Governor Neville, and will be recommended by the War Department for similar rank in the regular army. Since 1912 General Harries has been a vice-president of H. M. Byllesby & Co. He is also president

Now in Command of Nebraska National Guard



BRIG. GEN. GEORGE H. HARRIES

of the Louisville Gas & Electric Co., the Omaha Electric Light & Power Co., the Arkansas Valley Ry., Light and Power Co. and an officer in a number of other large utility organizations. During the past several months General Harries has been engaged in work for the Council of National Defense and War Department. The son of an officer in the British army, born in Wales in 1860, General Harries came to the United States when a boy and served as a scout under Generals Miles and Crook in frontier wars with the Indians. He was a member of the Government's commission settling the grievances of the Sioux Indians in 1891. In 1888 he went to Washington, D. C., later becoming president of the Metropolitan R.R. in that city. From 1897 to 1917 he was brigadier general in command of the military and naval forces of the District of Columbia, retiring as major general May 26 of the latter year. During the Spanish-American War he served as colonel of the First District of Columbia Infantry, United States Volunteers.

H. G. KELLEY, vice president of the Grand Trunk Ry., has assumed the duties of E. J. CHAMBERLIN.

president, during the latter's absence on a three months' leave.

CHARLES ALLEN GOODNOW has been appointed vice president of the Chicago, Milwaukee & St. Paul Ry. Entering the railroad service in 1868 with the Vermont & Massachusetts R.R., he became superintendent of the New Haven & North Hampton R.R. in 1881, and in 1886 was appointed superintendent of construction with the Chicago, Milwaukee & St. Paul Ry., being promoted in 1888 to division superintendent, with headquarters at Dubuque. In 1902 he was appointed general manager of the Chicago, Rock Island & Pacific Ry., and in November, 1903, became general manager of the Chicago & Alton R.R. Assistant to the president of the Chicago, Milwaukee & Puget Sound R.R. from 1908 to 1913, on the latter date he became assistant to the president of the Chicago, Milwaukee & St. Paul Ry., and had under his charge the electrification of that road from Freeport, Mont., to Deer Lodge, which work was remarkable for the rapid progress made and the results achieved in but three years of work. Mr. Goodnow also constructed the Gallatin Valley Ry., a subsidiary of the St. Paul, and is now president of that line. Many interesting innovations can be traced to Mr. Goodnow, such as interlocking plants, English staff machines, the perfection of the Manual Block System as now in use on the St. Paul, and the introduction of the floating system of handling freight on Puget Sound.

J. F. DEIMLING, assistant chief engineer of the Michigan Central R.R. at Detroit, Mich., has been appointed acting chief engineer, vice GEORGE H. WEBB, who has been commissioned lieutenant colonel in the Sixth Engineer Regiment.

R. S. REYNOLDS, formerly with WALTER G. KIRKPATRICK, civil engineer, Birmingham, Ala., is now in the Aeronautical Drafting Division of the Bureau of Construction and Repair, U. S. Navy, Washington.

HERMAN C. NUFFER has resigned as county surveyor of Franklin County, Idaho, and is now assistant engineer in the United States Indian Irrigation Service, with headquarters at Albuquerque, New Mexico.

OBITUARY

PROF. ALBERT F. GANZ, of Stevens Institute, Hoboken, N. J., died July 27. He was born in Elberfeld, Germany, Apr. 25, 1872, and came to this country in 1881. In 1902 he was appointed professor of electrical engineering at Stevens. To readers of *Engineering News-Record* he was best known through his work in the field of electrolysis. He was chairman of the committee on electrolysis of the American Water-Works Association and was the author of many papers on the subject of stray electric currents and their effects. Prof. Ganz did much consulting work in this specialized field.

JAMES E. JENKINS, who was associated with H. R. BEEBE, civil engineer and contractor, Utica, N. Y., died, July 5, at Saranac Lake, N. Y. In 1897 Mr. Jenkins was engaged on the Oswego-Little Falls section of the deep waterway survey; and on the Trenton Falls, N. Y., power development from 1898 to 1901. Graduating from the Rensselaer Polytechnic Institute in 1904, he was in charge of the alignment of the eastern sections of tunnels A and B under the East River, and then engineer for Thomas Crimmins Contracting Co. on barge canal contracts near Lockport, N. Y. Subsequently he was engineer for Smith, Hauser & Locker Co. on the section of the Catskill Aqueduct from 96th St. to 14th St., New York City. His health having become impaired on this work, he accepted a position as superintendent and general manager for the Cook Construction Co. on the Montreal aqueduct, and later was engineer for John W. Cowper Co. on a large chemical mill at Buffalo.

JOHN F. CONWAY, at one time assistant superintendent of the Bureau of Sewers, Manhattan, New York City, died July 10 in Brooklyn, New York.

Engineer Officers' Reserve Corps Assignments

The following-named officers of the Engineer Officers' Reserve Corps are relieved from their obligations in connection with their enlistments at the Engineer training camps named below and are assigned to active duty.

At Vancouver Barracks, Washington —Capt. Bertram D. Dean, First Lieuts. Franklin W. Bush, Jr., Harold Cogswell, Merrill Butler, Frank M. House, Arthur M. Bohnert, and Roy E. Tremourex. Second Lieut. Ernest M. Wright.

In the vicinity of Washington, D. C. —Capts. John W. Mark, George H. Throop, Oscar B. Perry, James G. Ross, John H. Watson and Martin P. Korn. First Lieuts. Harwood S. Haynes, Merritt T. Cooke, Jr., Harry S. Abell, Albert O. Loomis, Ira B. Pearce, Isadore E. Behrman, Page B. Blakemore, Paul Freedley, Ambrose Harwell, Philip O'B. Montgomery, Carl L. Raymond, Lois L. Adams, Caleb S. Kenny, Herbert I. Collins, William V. Hill, William S. Grace, James C. Fitz-Simons and Willard W. Troxwell. Second Lieuts. John E. Morelock, Hugh M. Heiskell, Gerald M. Keith, Orris S. Wood, Robert L. Glose, Frederic F. Frech, Charles H. Chandler, Jr., Ephraim, B. Wilkinson, Frank S. Neely, Kenneth B. Jones, John S. Beck and William A. Richards.

At Fort Leavenworth, Kans.—Maj. Walter E. Winn; Capts. Henry N. Brooks, Rennie B. Fanning, Frederick R. Giertsen, Albee L. Ladd, George G. Stroebe, Warren R. Thompson, George C. Parsons, George Goldman, George A. Knapp, Frank B. Watterson, Oscar W. Urbom, Charles S. Rogers, Chester A. Rothwell, Benjamin H. Lampert, Byron L. Kelso, and Walter V. Buck; First Lieuts. Leroy Johnson, Charles M. Seymour, Meyer Barnert, Samuel E. Minor, Henry V. Hubbard, Bjarne N. Folling, Horace C. Rawson, Jonathan W. Freeman, Frank Scott, Gordon A. Beebe, Allison T. Yorton, Edward A. Wood, Arnold A. Kriegsmann, Gerald S. Kibbey, Royal S. Durrell, George A. Geib, Ralph G. Aultman, Leo H. Weisfeld, Chancey L. Currier, Lewis H. Merrill, Ray E. McCurdy, Samuel J. Gates, Robert R. Fisher, Jamison Vawter, Edward W. Falanders, John T. Watry, Andrew H. Holt, Victor Morris, Robert J. Parmenter, Prescott G. Brown, Jessel S. Whyte, William E. Stanley, Malcolm K. Whyte, Jerome Powers, Dan S. Helmick, and James B. Black; Second Lieuts, Harvey A. Wood, Bolling W. Coulter, Edward Illsley, Robert A. Thurstin, Arthur W. Baumgarten, John E. Hayden, John A. B. Tompkins, Leslie A. Kibbe, Lynn U. Martin, Dudley K. Sadler, Edwin J. Stephenson, Clyde F. Weingartner, Albert M. Bowles, Waldimar Karkow, Walter S. Shively, Eugene L. Colcord, William D. Stuart, Jr., Neil A. Fowler, James F. Lardner, Jr., David H. Levy, Charles W. Campbell, Donald M. Cook, Francis J. Sherwin, Russell F. Albert, John D. Gould, Ralph L. Nessler, Kenneth A. Barren, Milton N. Levy, Charles K. Dunn, and John L. Niesse.

BUSINESS NOTES

B. ORUM ANDERSEN has become connected with Aall & Co., of Tokio, the Japanese agents for the American Steel Export Company.

The Osborn Engineering Co. announces that at the annual meeting of stockholders the following officers were elected: F. T. OSBORN, president; B. L. GREEN, vice president and general manager; P. P. EVANS, secretary; and L. C. MIDDOUGH, treasurer.

SLOANE, HUDDLE, FUESTEL & FREEMAN, consulting engineers, Chicago, have been retained by the Rhode Island legislature to investigate the affairs of the Rhode Island Co. street-railway system.

J. H. FLYNN has been appointed manager of the bucket department of the Blaw-Knox Co. Mr. Flynn was draftsman for the Isthmian Canal Commission and later mechanical engineer on the same work, serving through the period of heavy construction until 1911. During the past six years Mr. Flynn has been connected with the Lines-Flynn Co., of New York City, handling a general line of contractors' equipment.